The Harman Kardon Model CD491

Manual No. 66A

ULTRAWIDEBAND LINEAR PHASE CASSETTE DECK

Technical Manual

harman/kardon
240 CROSSWAYS PARK WEST, WOODBURY, N.Y. 11797
1112-H15266A1 P-08836 250 PRINTED IN JAPAN

SPECIFICATIONS

Track Configuration: 4-track 2 channel Stereo Cassette Deck

•MECHANICAL SECTION	Nominal	Limit
Record/Playback Tape Speed		
Deviation 4.75cm/sec.	0.3%	+1.0% −0.5%
Drift 4.75cm/sec.		0.2% ≦ 0.5%
Wow and Flutter	0.025% (NAB)	≦ 0.038%
	0.033% (CCIR)	≦ 0.1%
Take Up Torque	55gcm	35 ~ 70gcm
Back Tension	6gcm	4.5 ~ 8gcm
F.FWD Torque	120gcm	90 ~ 150gcm
REW. Torque	110gcm	90 ~ 150gcm
F.FWD/REW. Time for C-60 Cassette		72 sec. ≦ 85 sec.
Motor	Direct Drive motor (Capstan) 2 Flat Torque DC motors (Reel & Assist)	

•AMPLIFIRE SECTION		
Bias Frequency		105kHz ± 5kHz
Record/Playback Sensitivity (Input 400Hz)		580mV ± 1dB
Signal-to-Noise Ratio at LINE input (Input 1kHz, 100mV)		
Dolby NR OFF	LN	50dB
	CrO_2	53dB
	Metal	52dB
Dolby NR B to ON	LN	59dB
	CrO_2	61dB ≧ 58dB
	Metal	60dB ≧ 58dB
Dolby NR C to ON	LN	69dB
	CrO_2	71dB ≧ 66dB
	Metal	70dB ≧ 66dB

		Nominal	Limit
Signal-to-Noise Ratio at MIC input (Input 1kHz, 1.5mV)			
Dolby NR B to ON (LN)		50dB	≧ 46dB
Dolby NR C to ON (LN)		57dB	
Channel Separation		43dB	≧ 35dB
Crosstalk		72dB	≧ 60dB
Record/Playback Distortion (Input 1kHz)	LN	1.3%	≦ 1.6%
	CrO_2	1.0%	≦ 3.0%
	Metal	1.0%	≦ 1.6%
MPX Filter Attenuation at 15kHz		0.3dB	≦ 1dB
at 19kHz		35dB	≧ 30dB
Erase Ratio (Input 80Hz)	LN	70dB	≧ 60dB
	Metal	65dB	≧ 60dB
Input Sensitivity (Input 1kHz)			
at MIC input	0.65mV	0.2(min) ~ 1.0(max)mV	
at LINE input	33mV	25(min) ~ 50(max)mV	
Input Impedance (Input 1kHz)			
at MIC input	1.3kΩ	1(min) ~ 2(max)kΩ	
at LINE input	23kΩ	19(min) ~ 30(max)kΩ	
Overload at MIC input (Input 1kHz)		90mV ≧ 20mV	

•DIMENSIONS (WxHxD): 17-7/16"x4-13/16"x13-9/16" (443 x 123 x 345mm)

•WEIGHT: 15 lbs. 14 oz. (7.2 kg)

•POWER SUPPLY

U.S.A. & Canada models: AC120V, 60Hz

General model: AC100/120/220/240V, 50/60Hz

•POWER CONSUMPTION

U.S.A. & Canada models: 55W

General model: 60W

PLAYBACK FREQUENCY RESPONSE
TEST TAPE: TCC-162C, TCC-262C

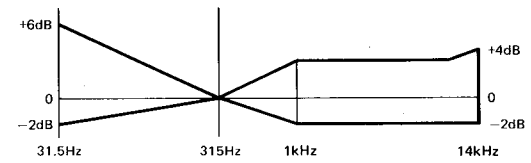


Fig. a

RECORD/PLAYBACK FREQUENCY RESPONSE
TEST TAPE: XL-1, AC-512, AC-711
DOLBY NR: OFF

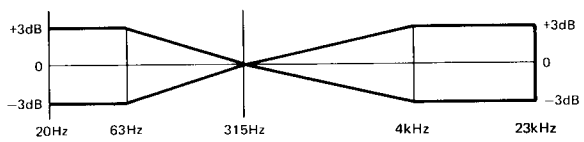


Fig. b

RECORD/PLAYBACK FREQUENCY RESPONSE
TEST TAPE: XL-1, AC-512, AC-711
DOLBY NR: TYPE B ON

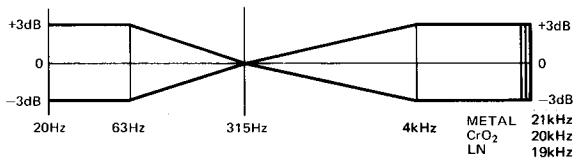


Fig. c

RECORD/PLAYBACK FREQUENCY RESPONSE
TEST TAPE: XL-1, AC-512, AC-711
DOLBY NR: TYPE C ON

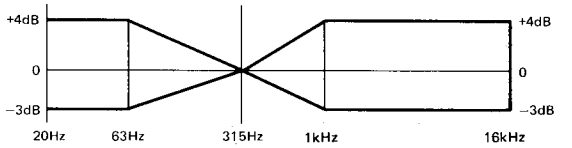


Fig. d

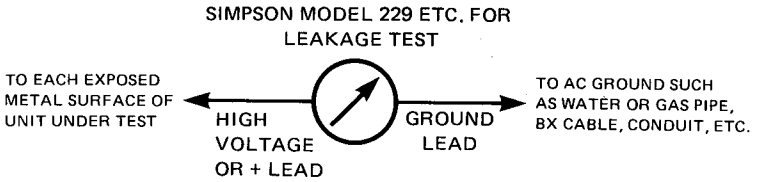
Specifications and components subject to change without notice. Overall performance will be maintained or improved.

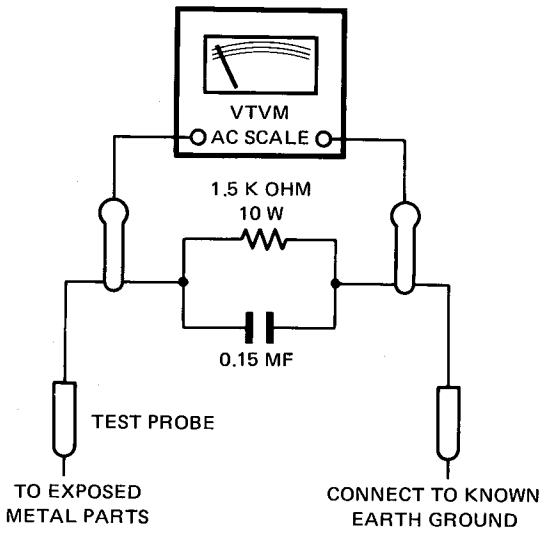
This specification is the target of servicing. But, there is a case that the specification is not applicable to the measurement condition and instrument.

LEAKAGE TEST

Before returning the unit to the user, perform the following safety checks:

1. Inspect all lead dress to make certain that leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the unit.
2. Be sure that any protective devices such as nonmetallic control knobs, insulating fishpapers, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacity networks, mechanical insulators, etc. which were removed for servicing are properly reinstalled.
3. Be sure that no shock hazard exists; check for leakage current using Simpson Model 229 Leakage Tester, standard equipment item No. 21641, RCA Model WT540A or use alternate method as follows:
   Plug the AC line cord directly into a 120-volt AC receptacle (do not use an Isolation Transformer for this test). Using two clip leads, connect a 1500 ohm, 10-watt resistor paralleled by a 0.15mf capacitor, in series with all exposed metal cabinet parts and a known earth ground, such as a water pipe or conduit. Use a VTVM or VOM with 1000 ohms per volt, or higher, sensitivity to measure the AC voltage drop across the resistor. (See Diagram.) Move the resistor connection to each exposed metal part having a return path to the chassis (antenna, metal, cabinet, screw heads, knobs and control shafts, escutcheon, etc.) and measure the AC voltage drop across the resistor. (This test should be performed with the power switch in both the On and Off positions.)
   A reading of 0.35 volt RMS or more is excessive and indicates a potential shock hazard which must be corrected before returning the unit to the owner.


SIMPSON MODEL 229 ETC. FOR LEAKAGE TEST
TO EACH EXPOSED METAL SURFACE OF UNIT UNDER TEST
HIGH VOLTAGE OR + LEAD
GROUND LEAD
TO AC GROUND SUCH AS WATER OR GAS PIPE, BX CABLE, CONDUIT, ETC.



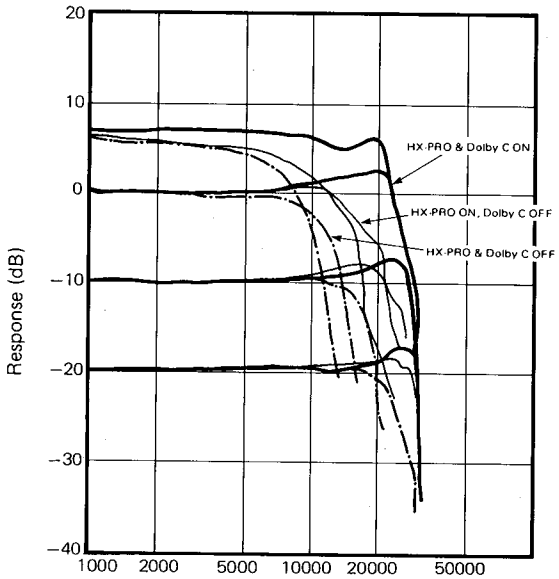
Dolby* HX-Professional Headroom Extension (HX-PRO) System

The CD491 is equipped with the Dolby HX-Professional Headroom Extension system (HX-PRO). It operates only during the record mode and does not require the user to "turn it on" or make adjustments. It is compatible with any low noise (standard), chromium dioxide (CrO_2), or metal audio cassette tape.

The effect of HX-PRO is that is extends the high frequency saturation (overload) level of the tape being recorded. Therefore, many of the high level, high frequency music signals that would be compressed or distorted with a conventional cassette deck will be recorded accurately by the CD491.

The advantages of HX-PRO are:

1. The performance of low noise and chromium dioxide tapes almost equals that of the more expensive metal tapes.
2. A major improvement is made in high frequency dynamic range.
3. The higher record levels result in an increased signal-to-noise ratio.
4. No decoding is necessary. The improved recording accuracy can be appreciated with any high quality tape player, including a portable or car stereo unit.
5. It can be used with or without Dolby B and C noise reduction circuitry.



Frequency Response

*Noise reduction and headroom extension manufactured under license from Dolby Laboratories Licensing Corporation. HX Professional originated by Bang and Olufsen. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation.

DISASSEMBLY PROCEDURES (REFER TO PAGES 17, 18, 19 AND 30)

1 CABINET TOP REMOVAL
Remove 6 screws Ⓐ and remove the cabinet top.

2 FRONT PANEL ASSEMBLY (103) REMOVAL
1. Remove the cabinet top. (Refer to step 1 .)
2. Pull off Master Fader, Output Level, Mic. Level and Rec. Level knobs (105 and 152).
3. Remove 6 screws Ⓑ and remove the front panel assembly (103).

3 LOGIC CONTROL P.C.BOARD(PCB-2) REMOVAL
1. Remove the cabinet top. (Refer to step 1 .)
2. Disconnect J801, J802, J803, J808 and J809 from P801, P802, P803, P808 and P809 on the logic control P.C. board (PCB-2).
3. Open the lid of connectors (P804, P805, P806 and P807) on the logic control P.C. board (PCB-2) and disconnect the lead wires.
4. Unsolder the lead wires connected to the logic control P.C. board (PCB-2).
5. Remove 4 screws Ⓒ and remove the logic control P.C. board (PCB-2) with heat sink (301).

4 PUSH SWITCHES P.C.BOARD(PCB-4) REMOVAL
1. Remove the cabinet top. (Refer to step 1 .)
2. Open the lid of connectors P451, J803, P804 and P401) on the main, logic control and VR P.C. boards (PCB-1, PCB-2 and PCB-3) and disconnect the lead wires.
3. Remove 3 screws Ⓓ and remove the push switches P.C. board (PCB-4) with rec. cal P.C. board (PCB-9). If necessary, unsolder the lead wires.

5 MAIN P.C. BOARD (PCB-1) REMOVAL
1. Remove the front panel assembly, logic control P.C. board (PCB-2) and push switches P.C. board (PCB-4). (Refer to steps 2 through 4 .)
2. Disconnect J501 and J503 from P501 and P503 on the main P.C. board (PCB-1).
3. Open the lid of connectors (P201, P202, P251, P301, P502, P551 and P601) on the main P.C. board (PCB-1) and disconnect the lead wires.
4. Unsolder lead wires connected to the main P.C. board (PCB-1).
5. Remove 2 screws Ⓔ and remove the tape monitor switch (SW406).
6. Remove 8 screws Ⓕ and remove the main P.C. board (PCB-1).

6 VR P.C. BOARD (PCB-3) REMOVAL
1. Remove the front panel assembly. (Refer to step 2 .)
2. Remove 6 screws Ⓖ and remove the cabinet bottom assembly (102).
3. Remove 4 hexagon nuts Ⓗ mounting the VR P.C. board (PCB-3) and remove it.

7 CASSETTE TAPE RECORDER MECHANICAL ASSEMBLY (113) REMOVAL
1. Remove the front panel assembly and logic control P.C. board (PCB-2). (Refer to steps 2 and 3 .)
2. Remove 4 screws Ⓘ and remove the cassette tape recorder mechanical assembly (113) with plate assembly (104) backward.

8 PLATE ASSEMBLY (104) REMOVAL
1. Remove the cassette tape recorder mechanical assembly. (Refer to step 7 .)
2. Remove 2 screws Ⓙ and remove the plate assembly (104).

9 DIRECT DRIVE MOTOR (506) REMOVAL
1. Remove the plate assembly. (Refer to step 8 .)
2. Remove 2 hexagon nuts Ⓚ and remove the direct drive motor. If necessary, unsolder the lead wires.

10 PAD ASSEMBLY (505) REMOVAL
1. Remove the plate assembly. (Refer to step 8 .)
2. Remove 2 screws Ⓛ and remove PAD assembly. If necessary, unsolder the lead wires.

11 IDLER MOTOR ASSEMBLY (503) REMOVAL
1. Remove the direct drive motor. (Refer to step 9 .)
2. Remove 2 lock washers Ⓜ and remove supply and take-up reel spindle assembly (508 and 509). At this time, remove the belt (511) and spring (507).
3. Remove 3 screws Ⓝ and remove the idler motor assembly.

12 HEAD BASE ASSEMBLY (502) REMOVAL
1. Remove the direct drive motor. (Refer to step 9 .)
2. Remove 2 E-stop rings Ⓞ and remove supply and take-up pinch roller assembly (516 and 513).
3. Remove the lamp holder assembly (519) and lamp holder mounting bracket.
4. Remove 2 E-stop ring Ⓟ and remove head base assembly with record/playback and erase heads.

CIRCUIT DESCRIPTION

- **MPX/DOLBY NR CIRCUIT**

The MPX filter circuit is turned on and off by the MPX filter switch. When it is off, the signals bypass the circuit. The dolby circuit is turned on and off by the dolby NR switch, and selected B and C types by the dolby NR type selector. When the circuit is on and type selector is B position, B-type dolby equalization is applied so that the signal is compressed during recording and expanded during playback.

- **MUTING**

1. PLAYBACK MODE

When the play button is pressed, the muting signal for the playback mode (which cuts the recording signal) is output from ① pin of the 4 bit micro computer IC851 and applied to Q701 (left channel) and Q702 (right channel). This turns on Q701 and Q702 to mute the recording signal.

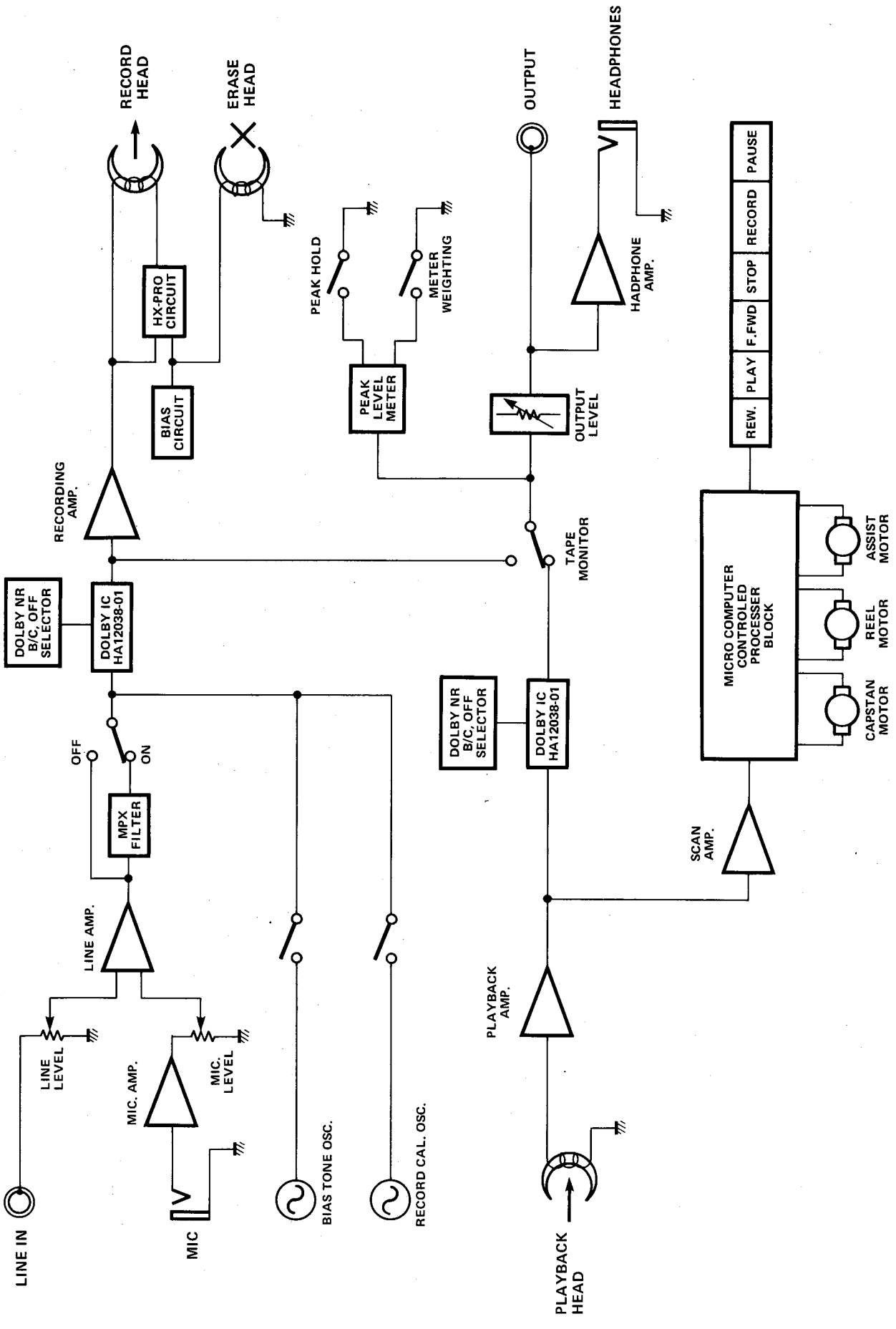
2. RECORDING MODE

When the record button is pressed, the muting signal for the record mode (which cuts the playback signal) is output from ③ pin of IC851 and applied to Q91 (left channel) and Q92 (right channel). This turns on Q91 and Q92 to mute the playback signal.

3. LINE MUTE (POWER SWITCH ON/OFF)

When the power is turned on, Q51 is turned on for a few seconds. At the same time Q93 and Q94 go on. ④ pin of the 4 bit micro computer IC851 becomes high level. The computer is reset. At the same time Q91 (left channel) and Q92 (right channel) are turned on. Thus, no shock noise is output to the OUTPUT terminals.

BLOCK DIAGRAM



Bias Fine Trim Feature

The optimal amount of recording bias varies from tape to tape. The bias fine trim feature is provided to enable precise adjustment for such variations.

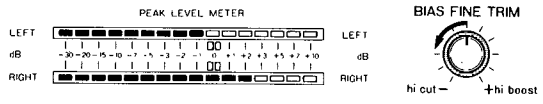
The high frequency range tends to be attenuated if the bias current is higher than the optimum value while it tends to be boosted if the bias current is less than the optimum value. Less than optimum bias also increases the amount of distortion in a recording.

This unit assists the user in determining the precise amount of bias, and therefore in obtaining the widest and flattest frequency response.

Operate as follows:

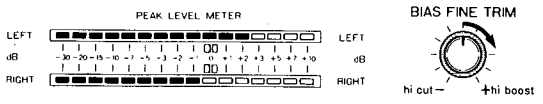
1. Insert a cassette tape in the CASSETTE COMPARTMENT and press the TAPE SELECTOR button corresponding to the type of tape being used.
2. Depress the TAPE MONITOR switch and make certain that the TAPE MONITOR indicator illuminates.
3. Press the RECORD and PLAY buttons together to start recording.
4. Hold the BIAS TONE button in. A 400Hz signal and a 12.5kHz signal are recorded in the left and right channels, respectively.
5. Compare the left and right channel PEAK LEVEL METER readings. If the amount of bias is optimum, the left and right channels will have the same reading. Turn the BIAS FINE TRIM knob counterclockwise (toward the direction marked as HI CUT) if the right channel reading exceeds the left channel reading or clockwise (toward the direction marked as HI BOOST) if the left channel reading exceeds the right channel reading.

If the right channel reading exceeds the left channel reading:



Turn the knob counterclockwise.

If the left channel reading exceeds the right channel reading:



Turn the knob clockwise.

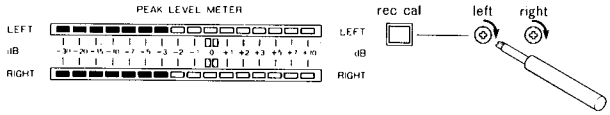
Record Calibration Feature

Each tape has different sensitivity. As a result, a tape that is recorded at a 0dB level may have a playback level that is either higher or lower than 0dB. The record calibration feature enables the user to precisely adjust the record/playback level so that both modes correlate. This is especially important when making Dolby NR encoded recordings.

Operate as follows:

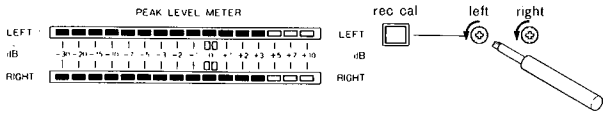
1. Insert the cassette tape to be recorded into the CASSETTE COMPARTMENT. Press the TAPE SELECTOR button according to the tape type.
2. Press the TAPE MONITOR switch and make certain that the TAPE MONITOR indicator illuminates.
3. Press the RECORD and PLAY button together to start recording.
4. Hold in the RECORD CALIBRATION button. A 400Hz signal is recorded on each channel.
5. If the PEAK LEVEL METERS show 0dB, no adjustment is required. If the indicated level is above or below 0dB, adjust the RECORD CALIBRATION control(s) of the left and right channels using a the screwdriver provided with your unit. If the indication of the PEAK LEVEL METER is below 0dB, turn the RECORD CALIBRATION control clockwise to adjust to 0dB. If the PEAK LEVEL METER reads above 0dB, turn the RECORD CALIBRATION control counterclockwise.

If the indication is below 0dB.



Turn the controls clockwise.

If the indication is above 0dB.



Turn the controls counterclockwise.

NOTE: Adjustment to 0dB may be impossible if the tape used is old or of poor quality.

ALIGNMENT PROCEDURES (REFER TO PAGES 29 AND 30)

■ ELECTRICAL ADJUSTMENT

1. Before adjustment

- After the power switch is pushed on, wait for 10 minutes before measuring to be sure of the most stable operation.
- Since head magnetization, dust accumulations, etc. are likely to introduce errors in the various characteristics, it is very important that the heads are properly demagnetized and cleaned before commencing any adjustment, particularly frequency response and head azimuth adjustment.

2. INSTRUMENTS REQUIRED

- Low frequency oscillator
- AC VTVM or dual channel AC VTVM
- Oscilloscope
- Wow/flutter meter
- Frequency counter

3. TEST TAPE

- Azimuth adjustment MTT-114
- Tape speed adjustment . . MTT-111 or MTT-111D
- Playback amp. level adjustment . . . . . MTT-150 or TCC-130
- Playback frequency characteristic confirmation . . . . . TCC-162C and TCC-262C
- Auto search adjustment MTT-150
- Auto search confirmation MTT-250B

Reference tapes

LN XL-1

CrO_2 . . . . . AC-512

Metal AC-711

Note:

C-90 differs with C-60 in the thickness and bias is unequal, so adjust with the tape whose bias is of specified value.

- **General conditions (unless otherwise noted).**

CONTROLS AND SWITCHES	SETTINGS
Dolby NR	off
MPX Filter	off
Tape Monitor	source
Bias Fine Trim	center
Timer	off
Output Level	max
Mic. Level	off
Rec. Level	max
Master Fader	max

STEP	ADJUSTMENT ITEM	INSTRUMENT REQUIRED	MODE	INPUT SIGNAL	POINT TO BE CONNECTED	ADJUST POINT	RATING	REMARKS
1	Azimuth	VTVM Test tape (MTT-114)	PB		TP501 or TP502	Azimuth screw	Maximum output	Refer to "Azimuth adjustment" on page 12.
2	Tape speed	Frequency counter Test tape (MTT-111 or MTT-111D)	PB		TP501 or TP502	VR built in motor	3kHz $^{+30}_{-15}$Hz	
3	Playback amp. level	VTVM Test tape (MTT-150 or TCC-130)	PB		TP501 TP502	VR101 VR102	580mV	
4	Playback frequency characteristic confirmation	VTVM Test tape (TCC-162C and TCC-262C)	PB		LINE OUTPUT		Confirm that frequency response is within the range in Fig. a.	
5	Auto search	VTVM Test tape (MTT-150)	PB		TP751	VR751	100mV	**Set the auto search mode.** **Tape selector is CrO_2 position.**
6	Auto search confirmation	Test tape (MTT-250B)						Refer to "Auto search operation confirmation" on page 9.
7	Step up trans.	VTVM	REC-PAUSE		TP203 TP204	L651 L203 L652 L204	Maximum output	Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise.
8	Bias trap	VTVM	REC-PAUSE		TP201 TP202	L205 L206	Minimum output	Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise.
9-1	Bias level (Pre-adjustment)	VTVM	REC-PAUSE		TP203 TP204	VR257 VR256	45mV	Tape selector is metal position.
9-2					TP203 TP204	VR255 VR254	22mV	Tape selector is CrO_2 position.
9-3					TP203 TP204	VR253 VR252	13mV	Tape selector is LN position.
10	Bias frequency confirmation	Frequency counter	REC-PAUSE		TP251		105kHz ± 5kHz	Tape selector is metal position.
11	Record level (Pre-adjustment)	VTVM Blank tape (AC-512)	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode.	TP501 TP502	VR201 VR202	580mV	Tape selector is CrO_2 position.
12	Peaking coil (Pre-adjustment)	VTVM	REC-PAUSE	Apply 27kHz signal to LINE INPUT. Set REC LEVEL knob so that TP101 and TP102 voltage is 580mV −25dB in REC-PAUSE mode.	TP201 TP202	L201 L202	Maximum output	Short the TP251 and TP252. Tape selector is metal position.
13-1	Record/Playback equalizer frequency characteristic	VTVM Blank tapes metal AC-711 CrO_2 AC-512 LN XL-1	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV −25dB in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	LINE OUTPUT	VR257 L201	So that the record/playback frequency response is flat (at least within the range in Fig. b.)	Tape selector is metal position.
13-2						VR256 L202		
13-3					LINE OUTPUT	VR255 L201	So that the record/playback frequency response is flat (at least within the range in Fig. b.)	Tape selector is CrO_2 position.
13-4						VR254 L202		
13-5					LINE OUTPUT	VR253 VR252	So that the record/playback frequency response is flat (at least within the range in Fig. b.)	Tape selector is LN position.

ALIGNMENT PROCEDURES (REFER TO PAGES 29 AND 30)

■ ELECTRICAL ADJUSTMENT

1. Before adjustment

- After the power switch is pushed on, wait for 10 minutes before measuring to be sure of the most stable operation.
- Since head magnetization, dust accumulations, etc. are likely to introduce errors in the various characteristics, it is very important that the heads are properly demagnetized and cleaned before commencing any adjustment, particularly frequency response and head azimuth adjustment.

2. INSTRUMENTS REQUIRED

- Low frequency oscillator
- AC VTVM or dual channel AC VTVM
- Oscilloscope
- Wow/flutter meter
- Frequency counter

3. TEST TAPE

- Azimuth adjustment MTT-114
- Tape speed adjustment . . MTT-111 or MTT-111D
- Playback amp. level adjustment . . . . MTT-150 or TCC-130
- Playback frequency characteristic confirmation . . . . . TCC-162C and TCC-262C
- Auto search adjustment MTT-150
- Auto search confirmation MTT-250B

Reference tapes

LN XL-1

CrO_2 . . . . . AC-512

Metal AC-711

Note:

C-90 differs with C-60 in the thickness and bias is unequal, so adjust with the tape whose bias is of specified value.

STEP	ADJUSTMENT ITEM	INSTRUMENT REQUIRED	MODE	INPUT SIGNAL	POINT TO BE CONNECTED
1	Azimuth	VTVM Test tape (MTT-114)	PB		TP501 or TP502
2	Tape speed	Frequency counter Test tape (MTT-111 or MTT-111D)	PB		TP501 or TP502
3	Playback amp. level	VTVM Test tape (MTT-150 or TCC-130)	PB		TP501 TP502
4	Playback frequency characteristic confirmation	VTVM Test tape (TCC-162C and TCC-262C)	PB		LINE OUTPUT
5	Auto search	VTVM Test tape (MTT-150)	PB		TP751
6	Auto search confirmation	Test tape (MTT-250B)			
7	Step up trans.	VTVM	REC-PAUSE		TP203 TP204
8	Bias trap	VTVM	REC-PAUSE		TP201 TP202
9-1	Bias level (Pre-adjustment)	VTVM	REC-PAUSE		TP203 TP204
9-2					TP203 TP204
9-3					TP203 TP204
10	Bias frequency confirmation	Frequency counter	REC-PAUSE		TP251
11	Record level (Pre-adjustment)	VTVM Blank tape (AC-512)	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode.	TP501 TP502
12	Peaking coil (Pre-adjustment)	VTVM	REC-PAUSE	Apply 27kHz signal to LINE INPUT. Set REC LEVEL knob so that TP101 and TP102 voltage is 580mV −25dB in REC-PAUSE mode.	TP201 TP202
13-1	Record/Playback equalizer frequency characteristic	VTVM Blank tapes metal AC-711 CrO_2 AC-512 LN XL-1	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV −25dB in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	LINE OUTPUT
13-2					
13-3					LINE OUTPUT
13-4					
13-5					LINE OUTPUT

- **General conditions (unless otherwise noted).**

CONTROLS AND SWITCHES	SETTINGS
Dolby NR	off
MPX Filter	off
Tape Monitor	source
Bias Fine Trim	center
Timer	off
Output Level	max
Mic. Level	off
Rec. Level	max
Master Fader	max

TO BE TED	ADJUST POINT	RATING	REMARKS
r	Azimuth screw	Maximum output	Refer to "Azimuth adjustment" on page 12.
r	VR built in motor	3kHz $^{+30}_{-15}$Hz	
	VR101 VR102	580mV	
TPUT		Confirm that frequency response is within the range in Fig. a.	
	VR751	100mV	**Set the auto search mode.** **Tape selector is CrO_2 position.**
			Refer to "Auto search operation confirmation" on page 9.
	L651 L203 L652 L204	Maximum output	Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise.
	L205 L206	Minimum output	Tape selector is metal position. Set the bias fine trim to hi cut position. Set VR256 and VR257 all the way to counterclockwise.
	VR257 VR256	45mV	Tape selector is metal position.
	VR255 VR254	22mV	Tape selector is CrO_2 position.
	VR253 VR252	13mV	Tape selector is LN position.
		105kHz ± 5kHz	Tape selector is metal position.
	VR201 VR202	580mV	Tape selector is CrO_2 position.
	L201 L202	Maximum output	Short the TP251 and TP252. Tape selector is metal position.
TPUT	VR257 L201 VR256 L202	So that the record/playback frequency response is flat (at least within the range in Fig. b.)	Tape selector is metal position.
TPUT	VR255 L201 VR254 L202	So that the record/playback frequency response is flat (at least within the range in Fig. b.)	Tape selector is CrO_2 position.
TPUT	VR253 VR252	So that the record/playback frequency response is flat (at least within the range in Fig. b.)	Tape selector is LN position.

STEP	ADJUSTMENT ITEM	INSTRUMENT REQUIRED	MODE	INPUT SIGNAL	POINT TO BE CONNECTED	A P
14	Record level	VTVM Blank tape (AC-512)	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	TP501 TP502	VF VF
15	Record level confirmation	VTVM Blank tapes [metal AC-711 LN XL-1]	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	TP501 TP502	
16	Playback trap	VTVM Blank tape (XL-1)	REC/PB	Apply 250Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode.	TP501 TP502	L1 L1
17	Record/playback equalizer frequency characteristic confirmation	VTVM Blank tapes [metal AC-711 CrO_2 AC-512 LN XL-1]	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	LINE OUTPUT	
18	Meter level	VTVM	REC-PAUSE	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 0.5dB below 580mV in REC-PAUSE mode.		VR VR
19	Record calibration tone level	VTVM	REC-PAUSE		TP561 TP562	VR
20	Bias tone	VTVM	REC-PAUSE		TP561 TP562	VR VR
21	LED display lighting level of record calibration tone confirmation		REC-PAUSE			
22	LED display lighting level of bias tone confirmation		REC-PAUSE			
23	MPX filter characteristic confirmation		REC-PAUSE	Apply 15kHz and 19kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode.	LINE OUTPUT	
24	Attenuation level confirmation	VTVM	REC-PAUSE	Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode.	TP201 TP202	
25	Boost level confirmation	VTVM	PB	Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP501 and TP502 voltage is 25dB below 580mV.	TP501 TP502	

OINT TO BE ONNECTED	ADJUST POINT	RATING	REMARKS
TP501 TP502	VR201 VR202	580mV	Tape selector is CrO_2 position.
TP501 TP502		580mV ± 0.5dB	This confirmation should be done at each tape selector position.
TP501 TP502	L101 L102	Minimum output	Tape selector is LN position. Dolby NR C is on.
NE OUTPUT		Confirm that record/play-back frequency response is within the range in Fig. c and Fig. d. If it is not within the specification, redo the adjustment and confirmation on steps 13, 15 and 16.	This confirmation should be done at each tape selector position under each of the following conditions, Dolby B and Dolby C on.
	VR401 VR402	Adjust to the point where the 0VU LED of the LED display lights.	
P561 P562	VR453	580mV	Keep pressing the REC CAL button. Adjust balance if there is a difference in output between the R and L channels.
P561 P562	VR451 VR452	580mV −20dB	Keep pressing the BIAS TONE button.
			Refer to "LED display light level confirmation" on page 9.
			Same as above.
NE OUTPUT		Confirm that attenuation of 15kHz and 19kHz is within the specification.	
P201 P202		Maximum output	Dolby NR C is on.
P501 P502		Maximum output	Dolby NR C is on.

STEP	ADJUSTMENT ITEM	INSTRUMENT REQUIRED	MODE	INPUT SIGNAL	POINT TO BE CONNECTED	ADJUST POINT	RATING	REMARKS
14	Record level	VTVM Blank tape (AC-512)	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	TP501 TP502	VR201 VR202	580mV	Tape selector is CrO_2 position.
15	Record level confirmation	VTVM Blank tapes metal AC-711 LN XL-1	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	TP501 TP502		580mV ± 0.5dB	This confirmation should be done at each tape selector position.
16	Playback trap	VTVM Blank tape (XL-1)	REC/PB	Apply 250Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode.	TP501 TP502	L101 L102	Minimum output	Tape selector is LN position. Dolby NR C is on.
17	Record/playback equalizer frequency characteristic confirmation	VTVM Blank tapes metal AC-711 CrO_2 AC-512 LN XL-1	REC/PB	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode. Then adjust with a 20Hz to 30kHz sweep signal.	LINE OUTPUT		Confirm that record/playback frequency response is within the range in Fig. c and Fig. d. If it is not within the specification, redo the adjustment and confirmation on steps 13, 15 and 16.	This confirmation should be done at each tape selector position under each of the following conditions, Dolby B and Dolby C on.
18	Meter level	VTVM	REC-PAUSE	Apply 400Hz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 0.5dB below 580mV in REC-PAUSE mode.		VR401 VR402	Adjust to the point where the 0VU LED of the LED display lights.	
19	Record calibration tone level	VTVM	REC-PAUSE		TP561 TP562	VR453	580mV	Keep pressing the REC CAL button. Adjust balance if there is a difference in output between the R and L channels.
20	Bias tone	VTVM	REC-PAUSE		TP561 TP562	VR451 VR452	580mV −20dB	Keep pressing the BIAS TONE button.
21	LED display lighting level of record calibration tone confirmation		REC-PAUSE					Refer to "LED display light level confirmation" on page 9.
22	LED display lighting level of bias tone confirmation		REC-PAUSE					Same as above.
23	MPX filter characteristic confirmation		REC-PAUSE	Apply 15kHz and 19kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 580mV in REC-PAUSE mode.	LINE OUTPUT		Confirm that attenuation of 15kHz and 19kHz is within the specification.	
24	Attenuation level confirmation	VTVM	REC-PAUSE	Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP561 and TP562 voltage is 25dB below 580mV in REC-PAUSE mode.	TP201 TP202		Maximum output	Dolby NR C is on.
25	Boost level confirmation	VTVM	PB	Apply 19.9kHz signal to LINE INPUT. Set REC LEVEL knob so that TP501 and TP502 voltage is 25dB below 580mV.	TP501 TP502		Maximum output	Dolby NR C is on.

■ AUTO-SEARCH OPERATION CONFIRMATION

- **Conditions**

Test tape	MTT-250B
Tape Selector	CrO_2
Dolby NR	off

1. Wind the test tape to its end and reset the counter to "0000".
2. Press the REW key to rewind the tape until the counter indicates around "9500".
3. Check for the following operation by pressing the F.FWD key and the PLAY key simultaneously.

Stop ——→ Auto-search (2 ~ 5 sec.)→
[Press F.FWD key and PLAY key simultaneously.] [PLAY indicator lights and F.FWD indicator flashes.]
→Rewind (about 0.5 sec.) →Playback

4. Repeat the same check as in step 3 a few times by pressing the F.FWD key and the PLAY key simultaneously.
5. With the test tape rewound fully, reset the counter to "0000".
6. Wind the tape on quickly until the counter indicates around "0050" by pressing the F.FWD key.
7. Check for the following operation by pressing the REW. key and the PLAY key simultaneously.

Stop ——→ Auto-search (2 ~ 5 sec.)→
[Press REW.key and PLAY key simultaneously.] [PLAY indicator lights and REW. indicator flashes.]
→Rewind (about 0.5 sec.)→Playback

8. Repeat the same check as in step 7 a few times by pressing the REW. key and the PLAY key simultaneously.

■ LED DISPLAY LIGHTING LEVEL CONFIRMATION

- **Conditions (unless otherwise noted)**

Output Level	Center
Mic. Level	Off
Bias Fine Trim	Center
Dolby NR	Off
MPX Filter	Off
Tape Monitor	Monitor

Connect a 10kΩ load resistors to LINE OUTPUT.

- **Test tape** MTT-150
- **Reference tapes**

LN	XL-1
CrO_2	AC-512
Metal	AC-711

1. **Dolby NR light level confirmation**
Play back the test tape (MTT-150) and confirm that the LED display lights to 0VU with the tape selector at both the LN position and the CrO_2 position. If the display does not operate as described above, make a readjustment by repeating steps 3 and 18 of Electrical Adjustment.

2. **REC. CAL. TONE and BIAS TONE light level confirmation**
   1) With the tape monitor switch set to source and the tape selector at the CrO_2 position, set the unit in the REC-PAUSE state. Then confirm that the LED display lights to 0VU when the REC CAL button is pressed.
   If the display does not operate as described above, make a readjustment by repeating step 19 of Electrical Adjustment.
   2) Check to ensure that the LED display lights to 0VU when the BIAS TONE button is pressed.
   If the display does not operate as described above, make a readjustment by repeating step 20 of Electrical Adjustment.
   3) With the tape selector at the LN and then the Metal position, check to ensure that the LED display reading does not change when the buttons are pressed as in steps 1) and 2).

3. **Playback level and playback frequency response confirmation of REC. CAL. TONE and BIAS TONE**
   1) With the tape selector set at the LN position, record the REC. CAL. TONE for more than 1 count indication of the counter. During playback, check to ensure that one of −1VU, 0VU and +1VU on the Lch of the LED display lights. If the display does not operate as described above, make a readjustment by repeating step 14 of Electrical Adjustment.
      Repeat the same check with the tape selector set to the CrO_2 position and then the Metal position. The level difference with the Rch must be within 1VU.
   2) As in step 1), record the BIAS TONE by pressing the BIAS TONE button and play it back. During playback, keep the BIAS TONE button depressed and check to ensure that one of −1VU, 0VU and +1VU on the Lch of the LED display lights. If the display does not operate as described above, make a readjustment by repeating step 14 of Electrical Adjustment.
      The level difference with the Rch must be within 1VU.

4. **Recording/playback frequency response correction confirmation by means of BIAS FINE TRIM**
   1) With the 2ch VTVM connected to the LINE OUTPUT terminals and the tape selector set to the CrO_2 position, record the BIAS TONE by pressing the BIAS TONE button and play it back. Note the output level of Lch and Rch when playing back and suppose it as 0dB.
   2) Turn the BIAS FINE TRIM all the way to the BOOST side and confirm that the output level changes more than +2dB. Then turn it all the way to the CUT side and confirm that the output level changes less than −2dB.
   3) Repeat the same confirmation procedure as in steps 1) and 2) with the tape selector set to the LN position and the Metal position respectively. The amount of the output level change should be more than +2dB on the BOOST side and less than −2dB on the CUT side.

5. **MEMORY, AUTO REWIND, AUTO REPLAY operation confirmation**
   1) With the AUTO REWIND and AUTO REPLAY switches in the OFF state, load the tape and wind it up to the end by pressing the F.FWD key. Then confirm that the AUTO STOP operation. The unit must stop automatically about 2 seconds after the tape was wound fully and the reel stopped.
   2) With the AUTO REWIND switch ON, rewind the tape (for any length) by pressing the REW key and then play it back to the end. Then confirm that the AUTO STOP operates about 2 seconds after the tape was fully wound up and the reel stopped and at the same time the REWIND operates automatically.
   3) With the MEMORY switch ON, wind the tape approximately half way, press the RESET switch to make the counter indication "0000" and wind the tape quickly by pressing the F.FWD key (for any length). Then press the REW. key to rewind the tape and confirm that the tape automatically stops somewhere between "0000" and "9999" on the counter.
   4) With the AUTO REPLAY switch ON, press the F.FWD key to wind the tape quickly (for any length). Then press the REW. key to rewind the tape and confirm that the tape stops automatically somewhere between "0000" and "9999" on the counter and at the same time the REPLAY operates.
   5) Furthermore, press the REW. key to rewind to the end of the tape and confirm that about 2 seconds after the tape was fully rewound and the tape stopped, the AUTO STOP operates and at the same time the REPLAY operates.

■ CASSETTE MECHANISM ADJUSTMENT AND CONFIRMATION

1. Pinch roller contact timing

1) Run the capstans by placing the POWER switch in the ON position.
2) Lift the head base slowly until the take-up pinch roller starts rotating. Then confirm that there is a clearance of 0.05 ~ 0.5mm between the supply pinch roller and the capstan.

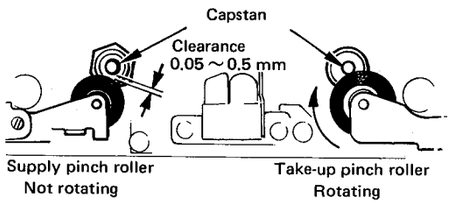


Fig. 1

3) If the pinch roller contact timing is simultaneous or reverse, advance the pinch roller contact timing of the take-up pinch roller by bending the A section in the below Fig. 2 in the arrow direction or replace the supply pinch roller assembly.

Note: If the contact timing has been adjusted by bending the A section of the head base, be sure to confirm after the adjustment that the capstan and the take-up pinch roller are not in contact while the deck is in the PAUSE mode.

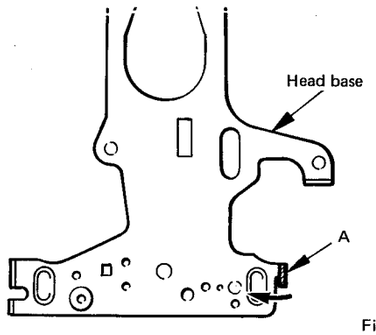


Fig. 2

2. Pinch roller parallelism confirmation

1) Push up the head base until right before the capstan and pinch roller contact and visually confirm for parallelism of each capstan and the pinch roller.

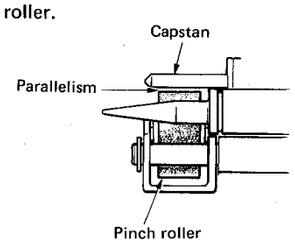


Fig. 3

2) If out of parallelism, check the pinch arm spindle for bend and if not bent, replace the pinch roller assembly.

3. Specification confirmation

Check for the following specifications.

1) Back tension 6gcm (4.5 ~ 8gcm)
2) Pinch roller pressure Tape-up 360g ± 40g
   Supply 260g ± 40g

4. Head height adjustment

1) Install the M-300 head gauge plate.
2) With the unit in the PLAY state, apply the adjustment chip to the head gauge plate and make an adjustment with the adjusting screws A and B in the below Fig. 4 so that the chip doesn't contact the tape guide.

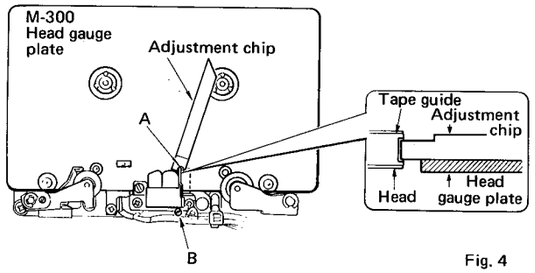


Fig. 4

5. Head penetration adjustment

1) Install the M-300 head gauge plate.
2) Apply the adjustment chip to the head and check for the chip to head clearance. If there is a clearance, make an adjustment with the adjusting screw C so that no clearance remains.

Note: 1. There should be no clearance at either record or playback head.
2. If there is a clearance at either record or playback head, adjust so that the clearance will be at the lower side as shown in the Fig. 5.
3. After the flapping adjustment, re-check the head height.

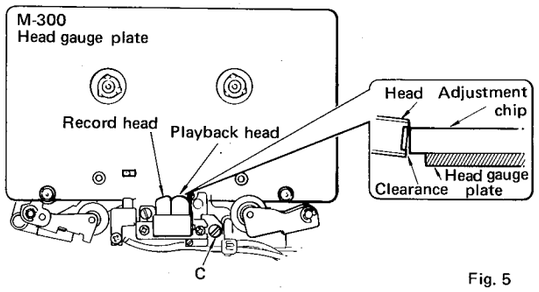


Fig. 5

6. Supply pinch roller height adjustment

1) Install the M-300 head gauge plate.
2) Set the unit in the PLAY state. With the adjustment chip applied to the tape guide of the supply pinch roller, check the tape guide to chip clearance. Make an adjustment with the adjusting screw D in the below Fig. 6 so that the upper and lower clearances become equal.
3) After the adjustment, repeat STOP-PLAY and re-check the height.

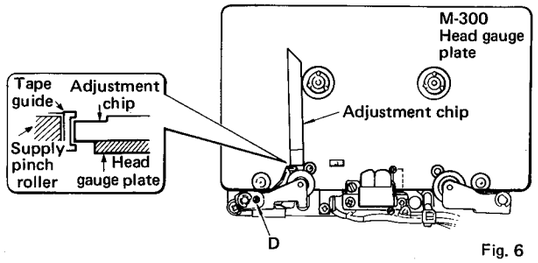


Fig. 6

7. Erase head flapping confirmation

As in step 5, visually check the erase head flapping. If the clearance is large, make an adjustment by inserting a spacer or replace the erase head.

8. Azimuth adjustment

When the maximum level point of R channel does not equal that of L channel, connect the oscilloscope as shown in Fig. 7 and proceed with azimuth adjustment so that L and R channels are in phase.

a) Connect L channel tape out to "X(or V)" and R channel to "Y(or H)". Observe the lissajouss waveform.
b) Set L and R channels to monaural. Adjust vertical and horizontal gain so that the waveform becomes 45 degree.
c) Adjust azimuth so that the measurement of "a" becomes maximum and the measurement of "b" becomes minimum against 45 degree line.

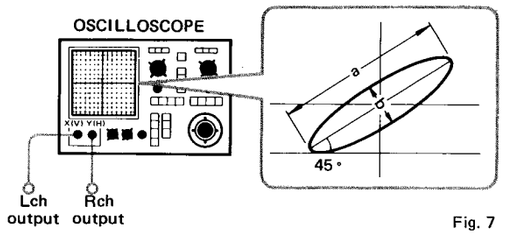


Fig. 7

9. Tape pass confirmation

1) With the mirror cassette (MC-109C without pad) in the PLAY state, check the tape for snaking or curling at the side.
2) Confirm by repeating PLAY-STOP more than twice.
   - Contact or curling at the tape guide
     Curling must be corrected but contact is acceptable.
   - Watch carefully between the tape guide of the pinch roller and the erase head as flapping tends to occur there.
   - If flapping exists, perform checking as described in the following 3) and on.
3) When the tape transport is unstable;
   a. Re-adjust the supply pinch roller height as in step 6. Then perform the azimuth adjustment as in step 10 and check the tape transit. If the tape transit is satisfactory, check to ensure that the erase head height is proper.
   b. If the pinch roller height adjustment can not correct the unstable tape transport, check each part for parallelism.
   ① Check the capstan spindle for tilt. If it has a tilt, try tilting the record and playback heads in the same direction.
   ② If the tape flapping exists right before the erase head, eliminate it by tilting the erase head with a spacer inserted A or B between the erase head and erase head base as shown in the Fig. 8.
   ③ Check for parallelism of the tape guide of the supply pinch roller and the capstan. If they are not parallel, replace the supply pinch roller assembly.
   ④ Check for parallelism of the take-up pinch roller and the capstan. If they are not parallel, replace the take-up pinch roller assembly.

Note: Make sure to perform the azimuth adjustment after each adjustment and then check the head height and flapping.

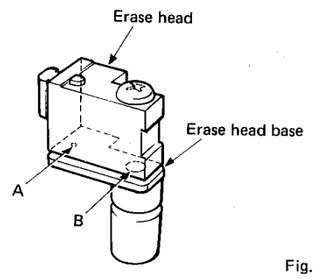


Fig. 8

■ CASSETTE MECHANISM ADJUSTMENT AND CONFIRMATION

1. Pinch roller contact timing

1) Run the capstans by placing the POWER switch in the ON position.
2) Lift the head base slowly until the take-up pinch roller starts rotating. Then confirm that there is a clearance of 0.05 ~ 0.5mm between the supply pinch roller and the capstan.

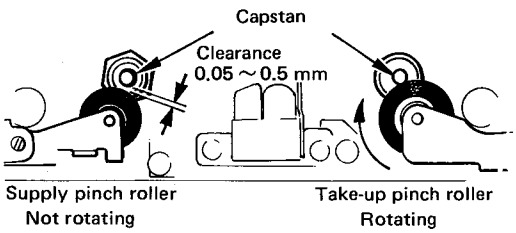


Fig. 1

3) If the pinch roller contact timing is simultaneous or reverse, advance the pinch roller contact timing of the take-up pinch roller by bending the A section in the below Fig. 2 in the arrow direction or replace the supply pinch roller assembly.

Note: If the contact timing has been adjusted by bending the A section of the head base, be sure to confirm after the adjustment that the capstan and the take-up pinch roller are not in contact while the deck is in the PAUSE mode.

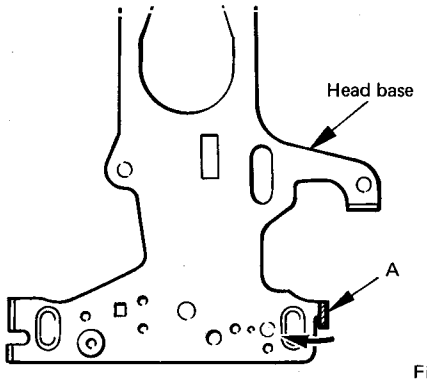


Fig. 2

2. Pinch roller parallelism confirmation

1) Push up the head base until right before the capstan and pinch roller contact and visually confirm for parallelism of each capstan and the pinch roller.

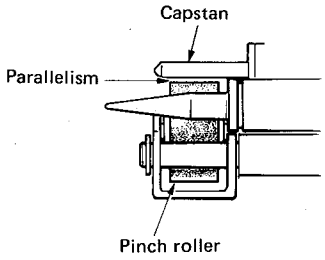


Fig. 3

2) If out of parallelism, check the pinch arm spindle for bend and if not bent, replace the pinch roller assembly.

3. Specification confirmation

Check for the following specifications.

1) Back tension 6gcm (4.5 ~ 8gcm)
2) Pinch roller pressure Tape-up 360g ± 40g
   Supply 260g ± 40g

4. Head height adjustment

1) Install the M-300 head gauge plate.
2) With the unit in the PLAY state, apply the adjustment chip to the head gauge plate and make an adjustment with the adjusting screws A and B in the below Fig. 4 so that the chip doesn't contact the tape guide.

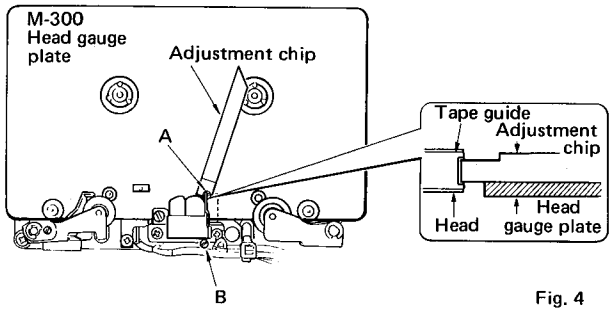


Fig. 4

5. Head penetration adjustment

1) Install the M-300 head gauge plate.
2) Apply the adjustment chip to the head and check for the chip to head clearance. If there is a clearance, make an adjustment with the adjusting screw C so that no clearance remains.

Note: 1. There should be no clearance at either record or playback head.
2. If there is a clearance at either record or playback head, adjust so that the clearance will be at the lower side as shown in the Fig. 5.
3. After the flapping adjustment, re-check the head height.

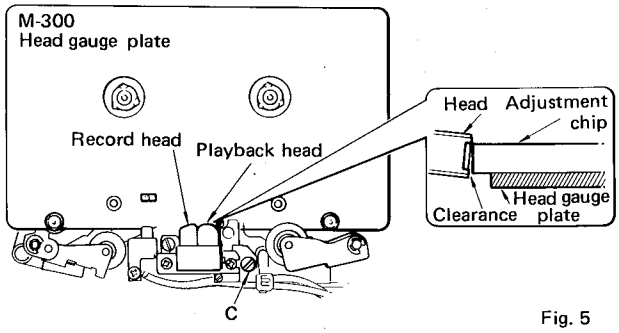


Fig. 5

6. Supply pinch roller height adjustment

1) Install the M-300 head gauge plate.
2) Set the unit in the PLAY state. With the adjustment chip applied to the tape guide of the supply pinch roller, check the tape guide to chip clearance. Make an adjustment with the adjusting screw D in the below Fig. 6 so that the upper and lower clearances become equal.
3) After the adjustment, repeat STOP-PLAY and recheck the height.

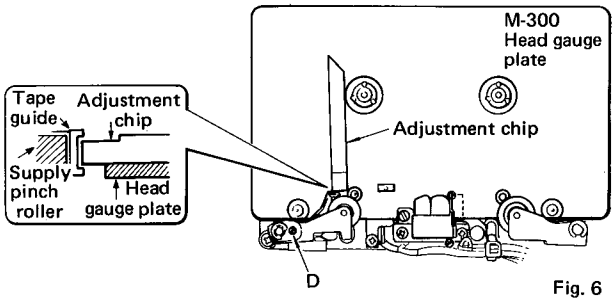


Fig. 6

7. Erase head flapping confirmation

As in step 5, visually check the erase head flapping. If the clearance is large, make an adjustment by inserting a spacer or replace the erase head.

8. Azimuth adjustment

When the maximum level point of R channel does not equal that of L channel, connect the oscilloscope as shown in Fig. 7 and proceed with azimuth adjustment so that L and R channels are in phase.

a) Connect L channel tape out to "X(or V)" and R channel to "Y(or H)". Observe the lissajouss waveform.
b) Set L and R channels to monaural. Adjust vertical and horizontal gain so that the waveform becomes 45 degree.
c) Adjust azimuth so that the measurement of "a" becomes maximum and the measurement of 'b" becomes minimum against 45 degree line.

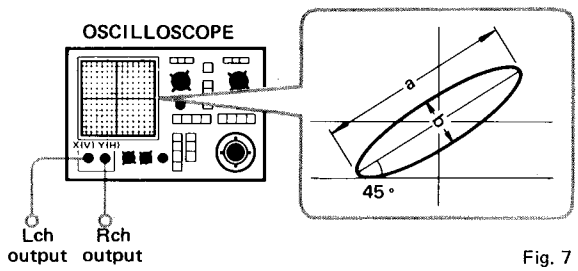


Fig. 7

9. Tape pass confirmation

1) With the mirror cassette (MC-109C without pad) in the PLAY state, check the tape for snaking or curling at the side.
2) Confirm by repeating PLAY-STOP more than twice.
   - Contact or curling at the tape quide
     Curling must be corrected but contact is acceptable.
   - Watch carefully between the tape guide of the pinch roller and the erase head as flapping tends to occur there.
   - If flapping exists, perform checking as described in the following 3) and on.
3) When the tape transport is unstable;
   a. Re-adjust the supply pinch roller height as in step 6. Then perform the azimuth adjustment as in step 10 and check the tape transit. If the tape transit is satisfactory, check to ensure that the erase head height is proper.
   b. If the pinch roller height adjustment can not correct the unstable tape transport, check each part for parallelism.

   ① Check the capstan spindle for tilt. If it has a tilt, try tilting the record and playback heads in the same direction.
   ② If the tape flapping exists right before the erase head, eliminate it by tilting the erase head with a spacer inserted A or B between the erase head and erase head base as shown in the Fig. 8.
   ③ Check for parallelism of the tape guide of the supply pinch roller and the capstan. If they are not parallel, replace the supply pinch roller assembly.
   ④ Check for parallelism of the take-up pinch roller and the capstan. If they are not parallel, replace the take-up pinch roller assembly.

   Note: Make sure to perform the azimuth adjustment after each adjustment and then check the head height and flapping.

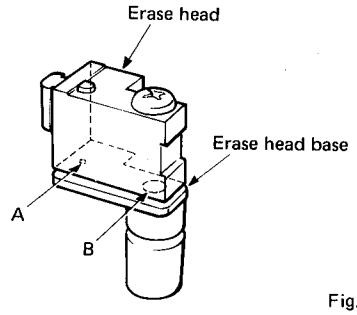
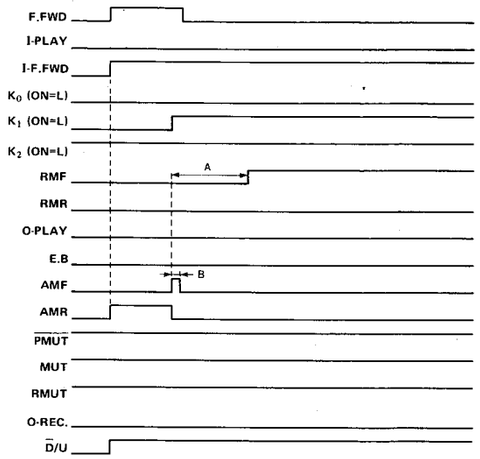


Fig. 8

TIMING CHART

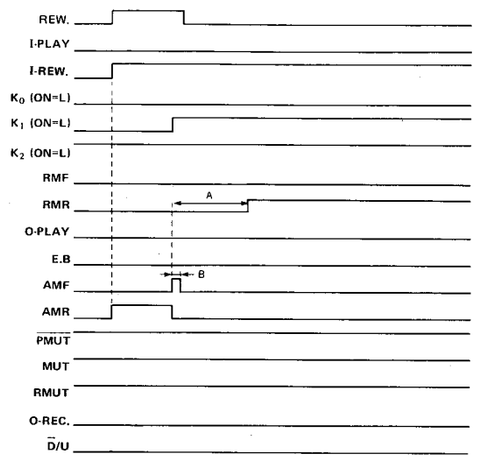
A = 130 msec.
B = 30 msec.

1. STOP → F.FWD



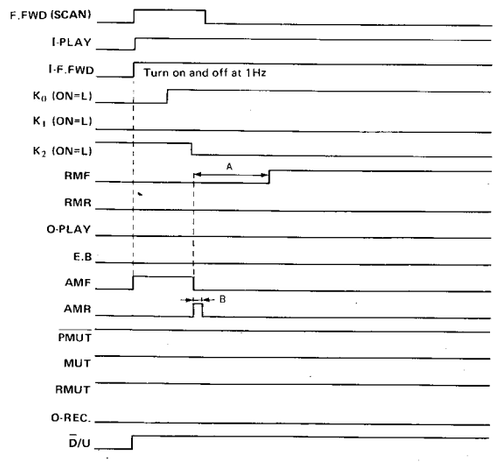
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. It performs auto stop and auto playback processing.

2. STOP → REW.



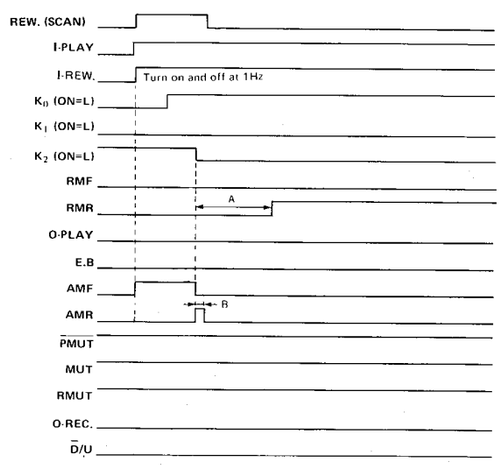
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at REW.
2. It performs auto stop and auto playback processing.

3. STOP → SCAN F.FWD



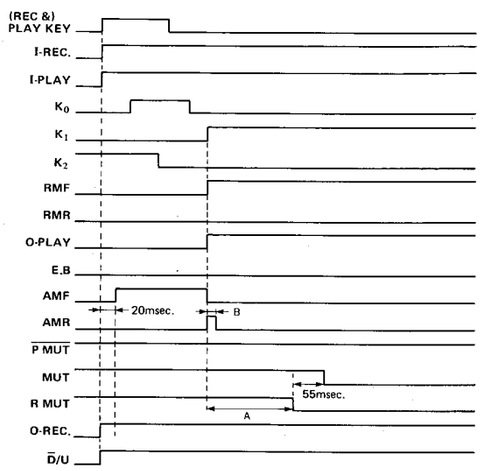
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. After AMR rises, if the set is in scan F.FWD, the computer checks scan signal and performs queing processing.

4. STOP → SCAN REW.



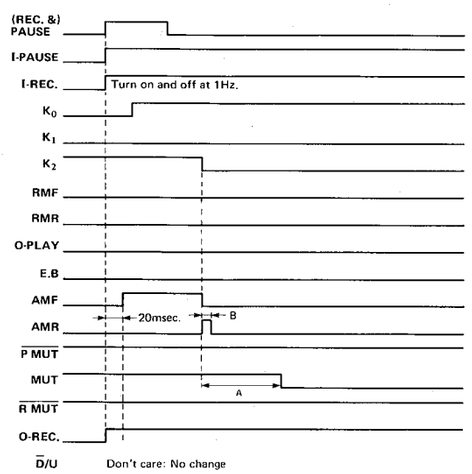
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. After AMR rises, if the set is in scan REW., the computer checks scan signal and performs queing processing.

5. STOP → RECORD & PLAYBACK



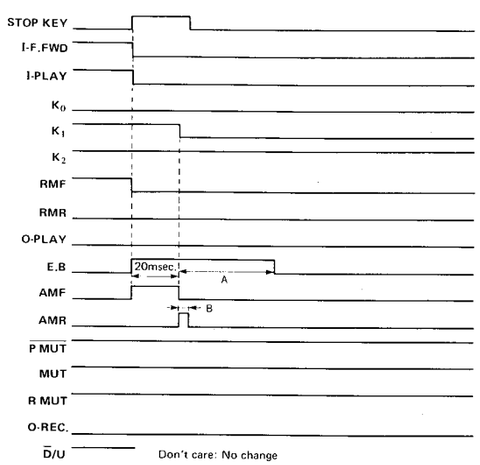
Cautions: 1. After RMF rises, the computer performs puls signal check, auto stop and auto rewind processing.
2. At timer play mode or immediately after attaching the cassette half, it performs correcting the slack of a tape.

6. STOP → RECORD-PAUSE

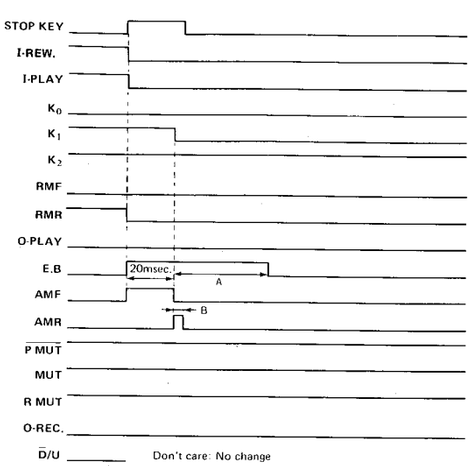


Cautions: 1. At recording pause, when play or pause key are depressed, the set switches over to recording mode.
2. Immediately after attaching a cassette half, when pause key performs correcting the slack of a tape.

7. F.FWD → STOP



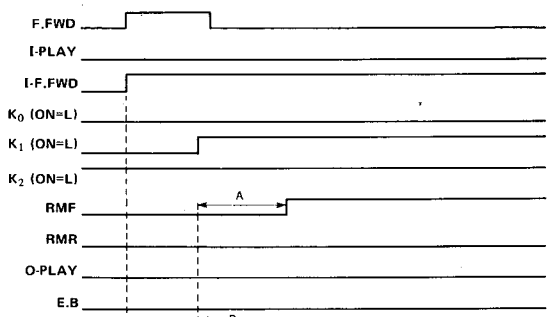
8. REW. → STOP



TIMING CHART

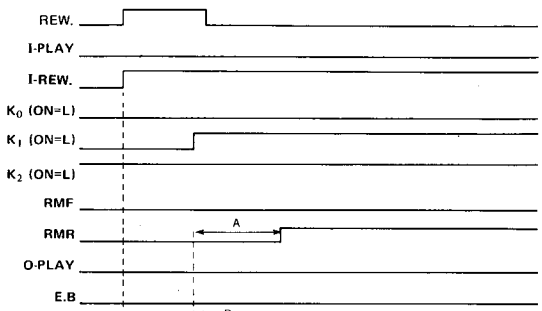
A = 130 msec.
B = 30 msec.

1. STOP → F.FWD



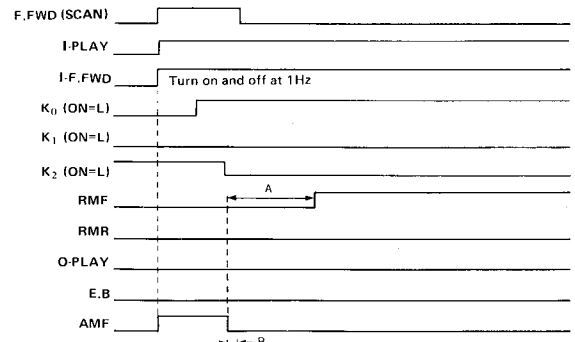
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. It performs auto stop and auto playback processing.

2. STOP → REW.



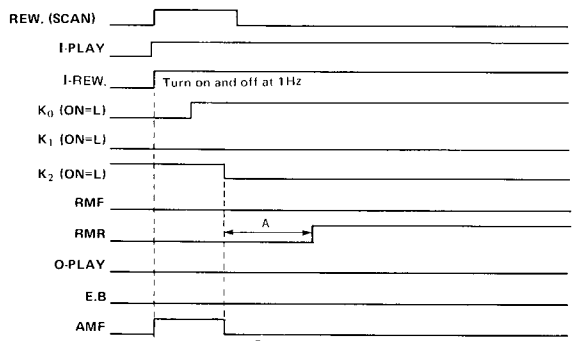
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at REW.
2. It performs auto stop and auto playback processing.

3. STOP → SCAN F.FWD



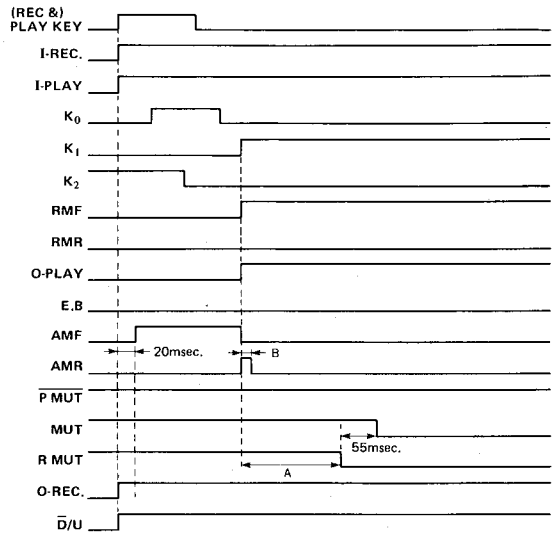
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. After AMR rises, if the set is in scan F.FWD, the computer checks scan signal and performs queing processing.

4. STOP → SCAN REW.



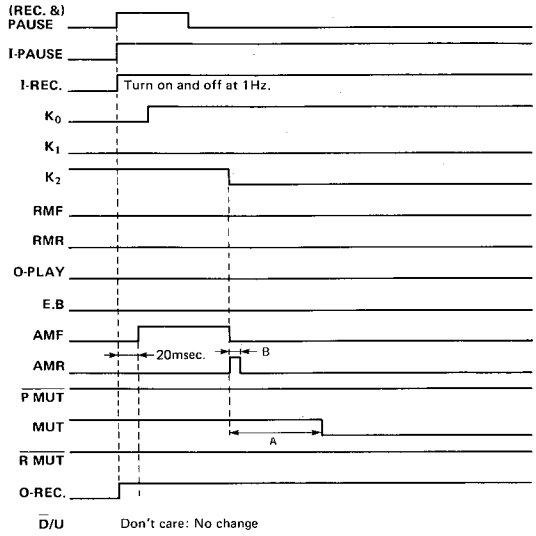
Cautions: 1. After AMR rises, the computer performs puls check and auto stop processing at F.FWD.
2. After AMR rises, if the set is in scan REW., the computer checks scan signal and performs queing processing.

5. STOP → RECORD & PLAYBACK



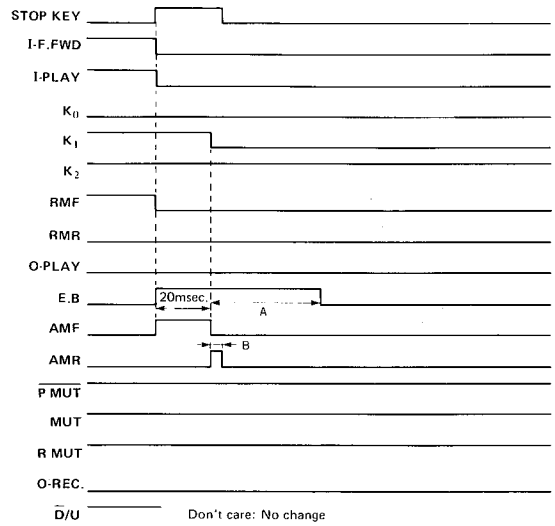
Cautions: 1. After RMF rises, the computer performs puls signal check, auto stop and auto rewind processing.
2. At timer play mode or immediately after attaching the cassette half, it performs correcting the slack of a tape.

6. STOP → RECORD-PAUSE

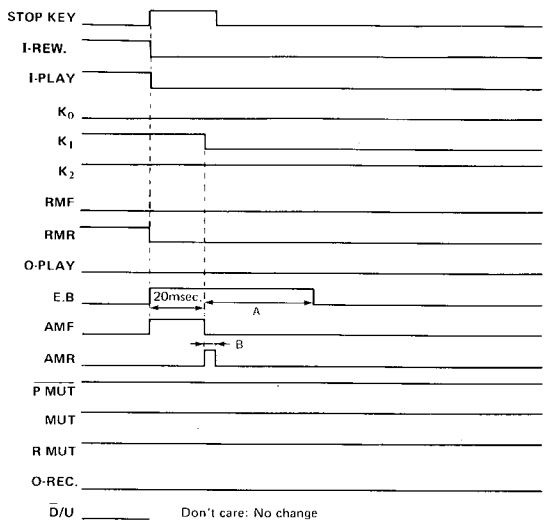


Cautions: 1. At recording pause, when play or pause key are depressed, the set switches over to recording mode.
2. Immediately after attaching a cassette half, when pause key performs correcting the slack of a tape.

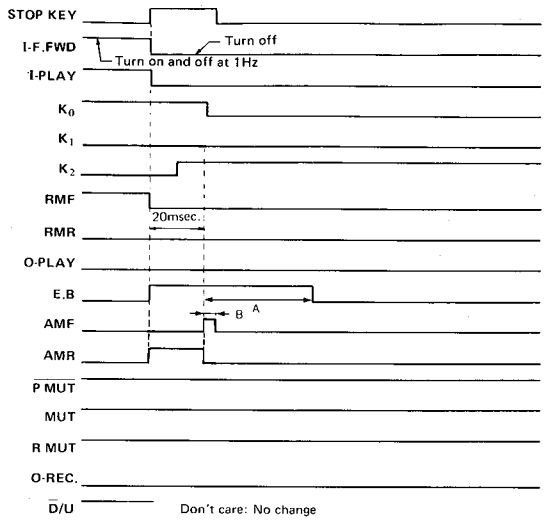
7. F.FWD → STOP



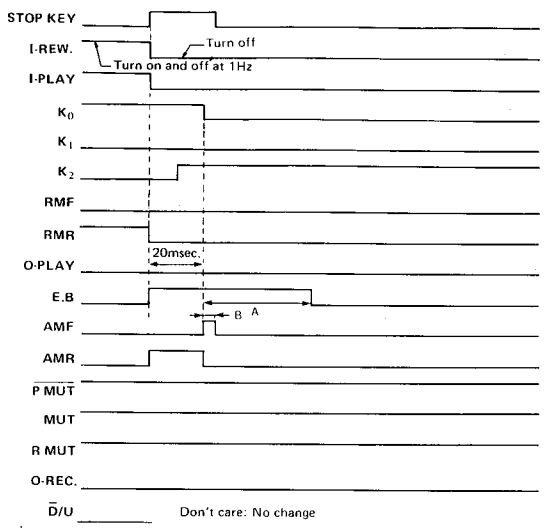
8. REW. → STOP



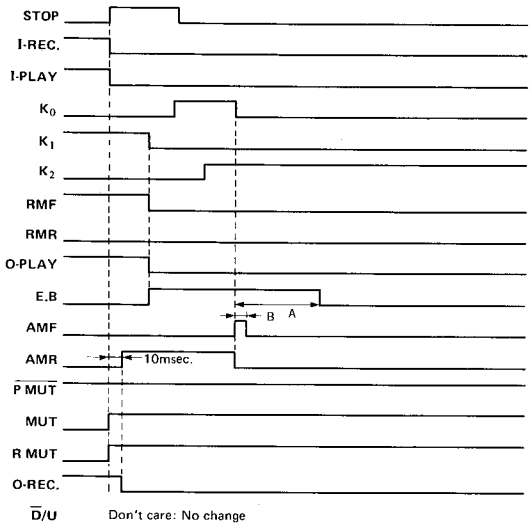
9. SCAN F.FWD → STOP



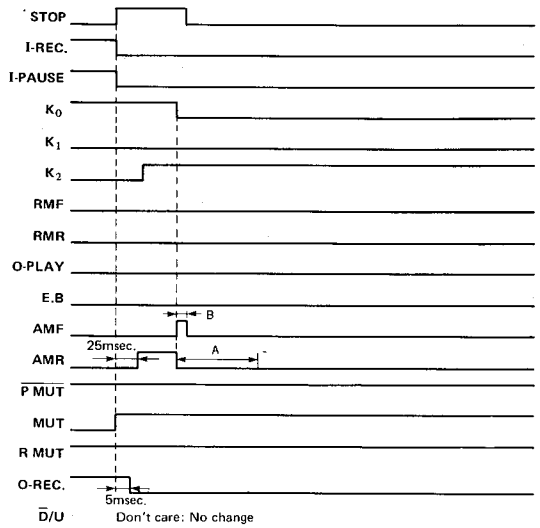
10. SCAN REW. → STOP



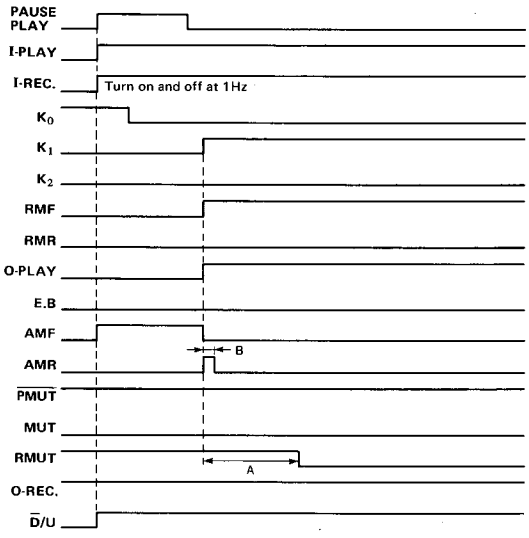
11. RECORD → STOP



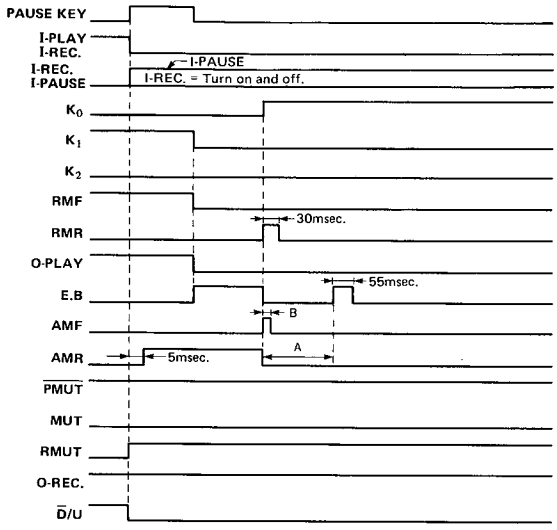
12. RECORD-PAUSE → STOP



13. RECORD-PAUSE → RECORD



14. RECORD → RECORD-PAUSE



Caution: After RMF rises, the computer performs puls check, auto stop and auto rewind processing.

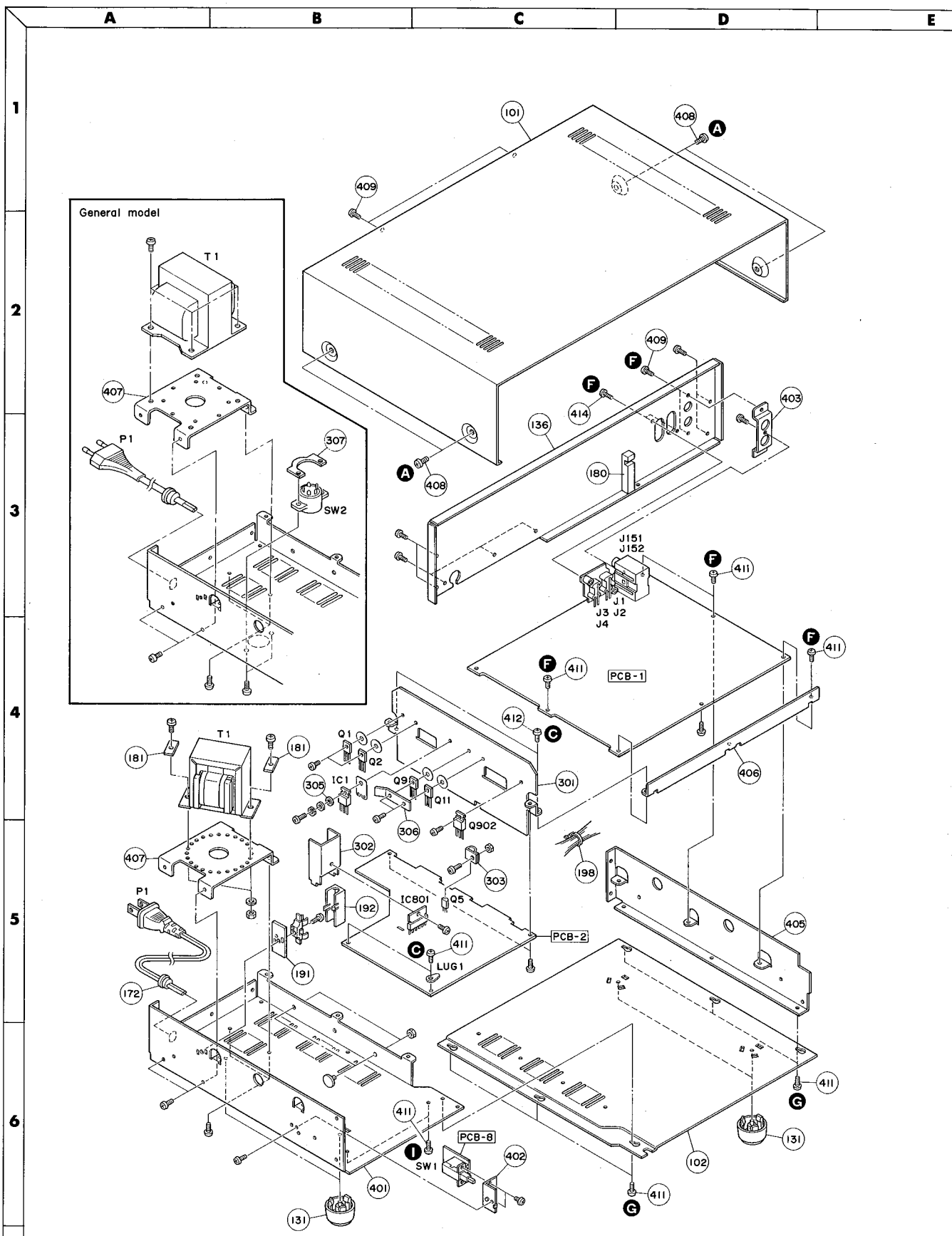
- **All sorts of operating mode and conditions of output signals (steady states)**

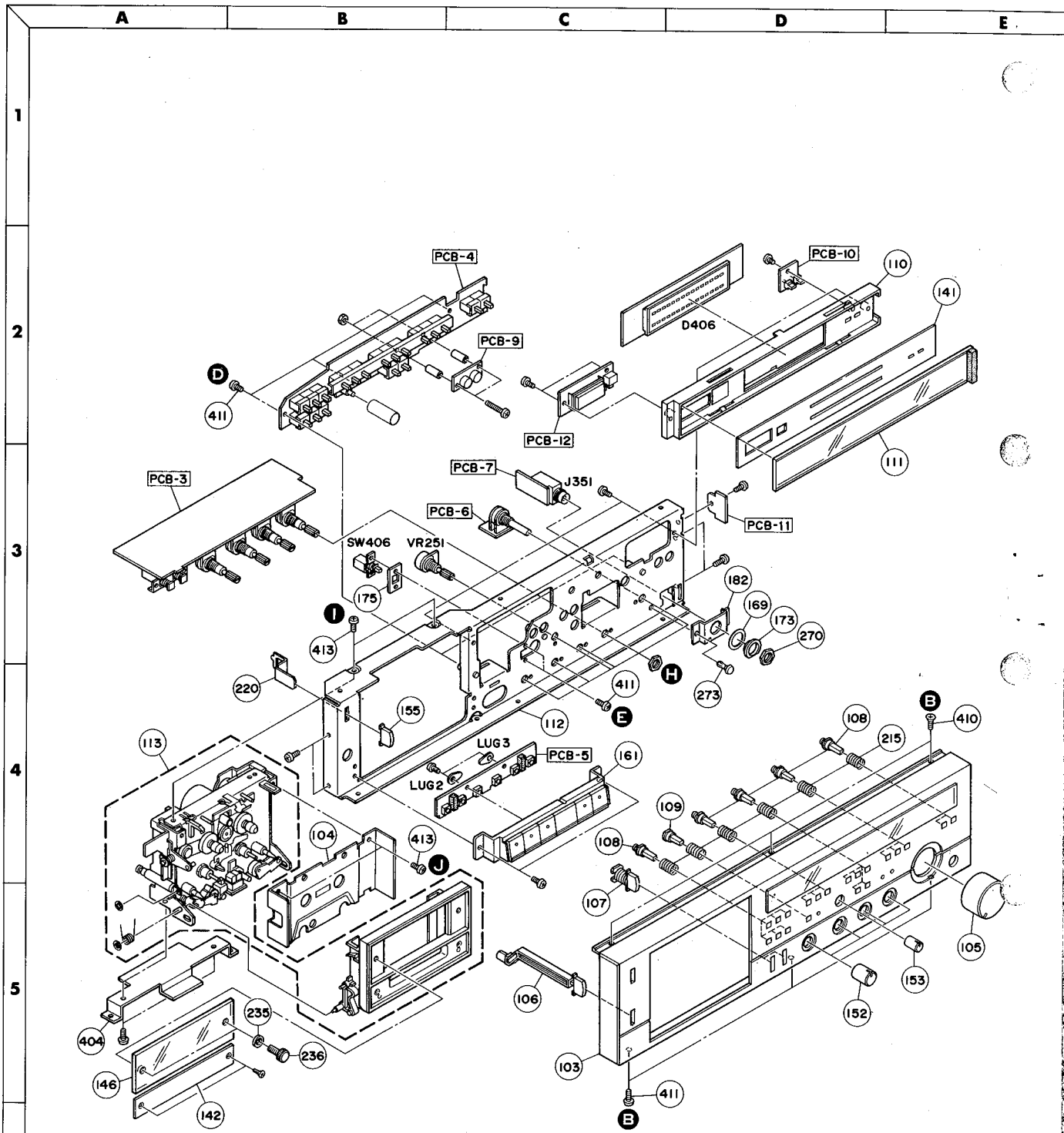
OUTPUT / MODE	I-REW.	I-PLAY	I-F.FWD	I-REC	I-PAUSE	RMF	RMR	O-PLAY	MUT	R MUT	O-REC.	D/U
REWIND	H	L	L	L	L	L	H	L	H	H	L	L
PLAYBACK	L	H	L	L	L	H	L	H	L	H	L	H
F.FWD	L	L	H	L	L	H	L	L	H	H	L	H
STOP	L	L	L	L	L	L	L	L	H	H	L	–
PAUSE	L	L	L	L	H	L	L	L	H	H	L	–
RECORD	L	L	L	H	L	H	L	H	L	L	H	H
RECORD PAUSE	L	L	L	H/L	H	L	L	L	L	H	H	–
SCAN (F.FWD)	L	H	H/L	L	L	H	L	L	H	H	L	H
SCAN (REW.)	H/L	H	L	L	L	L	H	L	H	H	L	L
AUTO SPACE	L	H/L	L	H	L	H	L	H	L	H	H	H

H; high level output transistor on
L; low level output transistor off
H/L; on/off at 1Hz 50% duty
- When it turns on and off from L, it starts from H.
- When it turns on and off from H, it starts from L.

–; Holds the before state.

GENERAL UNIT EXPLODED VIEW




A
B
C
D
E
1
2
3
4
5
6
7
PCB-4
PCB-9
PCB-10
PCB-12
D406
110
141
111
411
PCB-3
PCB-7
J351
PCB-6
PCB-11
SW406
VR251
175
182
169
173
270
413
220
411
273
155
112
LUG3
LUG2
PCB-5
161
113
104
413
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215
410
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153
152
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404
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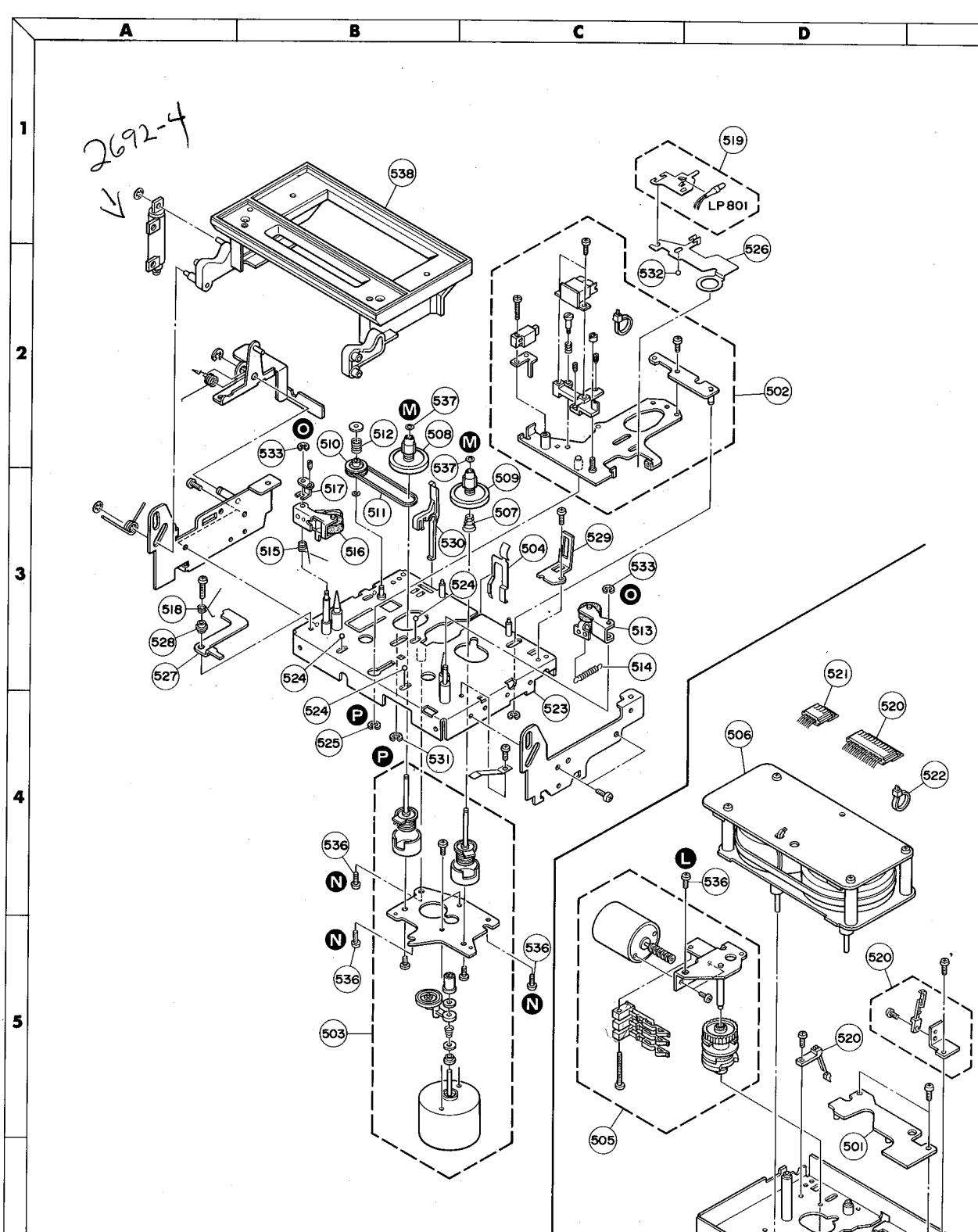
142
103
411

CASSETTE MECHANISM EXPLODED VIEW



GENERAL UNIT PARTS LIST

Ref. No.	Part No.	Description
101	A414-CD491A	Cabinet Top Assembly
102	A424-CD491A	Cabinet Bottom Assembly (U.S.A. & Canada models)
"	A424-CD491B	Cabinet Bottom Assembly (General model)
"	A424-CD491C	Cabinet Bottom Assembly (General model Black Face version)
103	A443-CD491A	Front Panel Assembly (U.S.A., Canada & General models)
"	A443-CD491C	Front Panel Assembly (General model Black Face version)
104	A514-CD491A	Plate Assembly
105	A630-CD491A	Knob Assembly, Master Fader (U.S.A., Canada & General models)
"	A630-CD491B	Knob Assembly, Master Fader (General model Black Face version)
106	A662-CD491A	Push Button Assembly, Power
107	A662-CD491B	Push Button Assembly, Rec. Mute, Auto Space
108	A662-CD491C	Push Button Assembly, Reset, Time, Count, Memory, Auto rewind/replay, Dolby NR, NR Type, MPX Filter, Bias/Equalization (METAL, CrO_2, LN), Bias Tone, Rec. Cal, Timer (Play, Off, Rec.), Peak Hold, Meter Weighting
109	A662-CD491D	Push Button Assembly, Tape Monitor
110	A731-CD491A	Indicator Holder Assembly
111	A443-CD491B	Indicator Panel Assembly
112	B211-CD491A	Chassis Assembly, Front
113	C112-CD491A	Cassette Tape Recorder Mechanical Assembly (U.S.A., Canada & General models)
"	C112-CD491B	Cassette Tape Recorder Mechanical Assembly (General model Black Face version)
131	1319-0139	Foot
136	1424-09301	Cabinet Back (U.S.A. & Canada models)
"	1424-09302	Cabinet Back (General model & General model Black Face version)
141	1513-04801	Plate
142	1513-05101	Dressing Plate (U.S.A., Canada & General models)
"	1513-05102	Dressing Plate (General model Black Face version)
146	1531-05601	Cassette Compartment Cover
152	1630-01901	Knob, Output Level, Mic. Level, Rec. Level (U.S.A., Canada & General models)
"	A634-CD491A	Knob Assembly, Output Level, Mic. Level, Rec. Level (Geneal model Black Face version)
153	1634-02701	Knob, Bias Fine Trim (U.S.A., Canada & General models)
"	1634-02702	Knob, Bias Fine Trim (General model Black Face version)
155	1662-05501VN	Push Button, Eject
161	3351-015	Push Button Assembly, Cassette Mechanism Control
169	2111-1356	Felt
172	2114-415027	Bushing
173	2114-72167	Bushing
175	2132-7115	Spacer
180	2114-71254	Bushing
181	2219-7093	Bracket
182	2219-7809	Bracket
191	2224-7061	Insulator (Except General model & General model Black Face version)
192	2240-7118	Holder (Except General model & General model Black Face version)
198	2240-7120	Holder
215	2651-2101705	Spring
220	2674-7013	Slider
235	2114-01224	Bushing
236	2310-7025	Special Screw
270	2440-61	Special Nut
273	2459-3003511	Rivet
301	2222-7147	Heat Sink
302	2222-7151	Heat Sink
303	2222-7067	Heat Sink
305	2114-71278	Bushing
306	2652-00309	Leaf Spring
307	2440-7017	Special Nut (Except U.S.A. & Canada models)
401	2211-7238	Chassis, Left (U.S.A. & Canada models)
"	2211-7245	Chassis, Left (General model & General model Black Face version)
402	2219-7811	Bracket, SW1
403	2219-7909	Bracket, Microphone Jack
404	2219-7910	Bracket, Cassette Mechanism Bottom
405	2219-7911	Bracket, Right

Ref. No.	Part No.	Description
406	2219-7924	Bracket, PCB-1 Mounting
407	2219-7937	Bracket, T1
"	2219-7963	Bracket, T1 (for General model)
408	2347-400647	Bind Head Tapping Screw
409	2347-300647	Bind Head Tapping Screw
410	2343-300627	Self-Tapping Screw
411	2347-300627	Bind Head Tapping Screw
412	2347-300827	Bind Head Tapping Screw
413	2347-260547	Bind Head Tapping Screw
414	2347-300841	Bind Head Tapping Screw
	1111-J30147	Owner Guide (U.S.A. model)
	1111-J30148	Owner Guide (Canada, General models & General model Black Face version)
	1221-897130	Packing Box
	1222-7184	Packing Cushion (2 Used)
	4474-29	AC Adaptor (General model & General model Black Face version)
	1192-1	Screw Driver, Rec. Cal. Tone Level ADJ.

CASSETTE MECHANISM PARTS LIST

Ref. No.	Part No.	Description
501	SIE08008-07	Rotation Sensor P.C. board
502	SIE02016-09	Head Base Assembly
503	SID05001-08	Idler Motor Assembly
504	SIE25017-01	Cassette Hold Spring
505	SIE09048-03	PAD Assembly
506	30A2NLB-51	Direct Drive Motor
507	SIE24010-03	Spindle Spring, Take-up Reel
508	SIE04006-02	Supply Reel Spindle Assembly
509	SIE04018-03	Take-up Reel Spindle Assembly
510	SIE14004-01	Pulley
511	SIE18001-07	Belt
512	SIE24034-01	Spring
513	SIE99017-02	Take-up Pinch Roller Assembly
514	SIE24017-01	Spring
515	SIE24068-02	Spring
516	SIE99018-02	Supply Pinch Roller Assembly
517	SIE12004-01	Adjustment Bracket, Supply Pinch Roller
518	SIE24007-01	Spring
519	SIE09025-01	Lamp Holder Assembly
520	SIE09129-01	Switch & Connector Assembly
521	SIE67065-01	Connector with Lead Wires, 6 Pos.
522	SIE33014-01	Holder, Lead Wires
523	SID01007-14	Chassis Assembly
524	SIE36002-01	Steel Ball
525	SIE36001-02	E-Stop Ring
526	SIE25010-01	Bracket, Head Base Hold
527	SIE21018-02	Lock Lever
528	SIE23004-01	Collar
529	SIE21015-02	Bracket, Cassette Detect Switch
530	SIE20006-01	Lever, Mis-Erase Protect Switch
531	SIE36001-01	E-Stop Ring
532	SIE36002-03	Steel Ball
533	22145	E-Stop Ring
534	SIE36014-01	Hexagon Nut
535	SEE30545-01	Pan Head Screw
536	SEE30535-01	Pan Head Screw
537	SEE10228-02	Washer
538	A614-CD491A	Cassette Compartment Slot Assembly (U.S.A., Canada & General model)
"	A614-CD491B	Cassette Compartment Slot Assembly (General model Black Face version)

ELECTRICAL PARTS LIST

Ref. No.	Part No.	Description
	CHASSIS MISCELLANEOUS	
P1	4161-0487	Power Cord
"	4161-7256	Power Cord (for General model)
T1	5584-703434	Power Transformer
"	5584-702434	Power Transformer (for General model)
VR251	5113-2028221	Control, 2kΩB, Bias Fine Trim
D406	5623-LT1107	L.E.D. Display, Peak Level Meter
SW2	4411-104736	Rotary Switch, Voltage Selector (for General model)
F1	5732-402031	Fuse, 4A, 125V (Except General model)
LUG1	4211-4	Lug Terminal
LUG2, 3	4211-6	Lug Terminal
	4472-0125	Fuse Holder (Except General model)
	PCB-1 MAIN P.C. BOARD	
	RESISTORS	
R101, 102, 531, 532, 591, 592	5174-563381	56kΩ, ±1%, 1/4W, Metal
R113, 114, 117, 118	5174-622381	6.2kΩ, ±1%, 1/4W, Metal
R115, 116	5174-123381	12kΩ, ±1%, 1/4W, Metal
R137, 138	5102-4704715	47Ω, ±2%, 1/4W, Fuse
R273, 274	5102-6804715	68Ω, ±2%, 1/4W, Fuse
R365, 366, 367, 368, 465, 466, 671, 672	5102-1004715	10Ω, ±2%, 1/4W, Fuse
R505, 506, 565, 566	5174-512381	5.1kΩ, ±1%, 1/4W, Metal
R507, 508, 567, 568	5174-153381	15kΩ, ± 1%, 1/4W, Metal
R557, 610	5102-1204715	12Ω, ±2%, 1/4W, Fuse
R651, 652	5174-104381	100kΩ, ±1%, 1/4W, Metal
R667, 668	5102-5604713	56Ω, ±2%, 1/4W, Fuse
R761	5102-1014715	100Ω, ±2%, 1/4W, Fuse
	CONTROLS	
VR101, 102, 254, 255, 256, 257	5101-20371920	20kΩB
VR252, 253	5101-50271920	5kΩB
VR451, 452, 751	5101-50371920	50kΩB
VR453	5101-50171920	500ΩB
	CAPACITORS	
C81	5352-224571	0.22μF, ±5%, 63V, Metalized Polyester
C101, 102	5353-270534	27pF, ±5%, 500V, Mica
C103, 104	5345-226C0226	22μF, ±20%, 16V, Electrolytic
C105, 106	5345-337A0952	330μF, ±20%, 6.3V, Electrolytic
C107, 108, 109, 110	5359-3927851	3900pF, ±2%, 100V, Polypropylene
C111, 112	5345-106C0226	10μF, ±20%, 16V, Electrolytic
C115, 116, 219, 220	5345-107C041	100μF, ±20%, 16V, Electrolytic
C151, 152, 155, 156	5345-106C0952	10μF, ±20%, 16V, Electrolytic
C153, 154, 251, 457, 458, 667, 668, 757, 758, 759	5345-476C041	47μF, ±20%, 16V, Electrolytic
C207, 208	5345-105F0951	1μF, ±20%, 50V, Electrolytic
C209, 210	5345-226C0952	22μF, ±20%, 16V, Electrolytic
C211, 212	5352-154571	0.15μF, ±5%, 63V, Metalized Polyester
C215, 216	5342-106C0951	10μF, ±20%, 16V, Electrolytic
C252	5342-476C0951	47μF, ±20%, 16V, Electrolytic
C351, 352, 353, 354, 551, 552, 611, 612	5345-226C041	22μF, ±20%, 16V, Electrolytic
C455, 456	5345-105F041	1μF, ±20%, 50V, Electrolytic
C501, 502, 527, 528, 561, 562, 587, 588, 615, 616	5345-106C0951	10μF, ±20%, 16V, Electrolytic
C503, 504, 563, 564	5345-107C0952	100μF, ±20%, 16V, Electrolytic
C505, 506, 553, 565, 566, 613, 614	5345-477C041	470μF, ±20%, 16V, Electrolytic
C507, 508, 509, 510, 567, 568, 569, 570	5359-153771	0.015μF, ±2%, 50V, Polypropylene
C511, 512, 539, 540, 571, 572, 599, 600	5345-L106M16	10μF, ±20%, 16V, Electrolytic
C517, 518, 543, 544, 577, 578, 603, 604	5345-L475M25	4.7μF, ±20%, 25V, Electrolytic

Ref. No.	Part No.	Description
C519, 520, 521, 522, 545, 546, 579, 580, 581, 582, 605, 606	5345-L154M50	0.15μF, ±20%, 50V, Electrolytic
C523, 524, 525, 526, 547, 548, 583, 584, 585, 586, 607, 608	5345-L474M50	0.47μF, ±20%, 50V, Electrolytic
C535, 536, 595, 596	5359-3327851	3300pF, ±2%, 100V, Polypropylene
C537, 538, 597, 598	5359-3927851	3900pF, ±2%, 100V, Polypropylene
C651, 652	5359-1515851	150pF, ±5%, 100V, Polypropylene
C661, 662	5359-3915851	390pF, ±5%, 100V, Polypropylene
C665, 666	5353-101534	100pF, ±5%, 500V, Mica
C756	5345-224F0952	0.22μF, ±20%, 50V, Electrolytic
	INTEGRATED CIRCUITS	
IC151	5652-M5218L	M5218L
IC201	5652-M5220P	M5220P
IC451, 653, 751	5652-M5218P	M5218P
IC501, 502, 561, 562	5652-12038-01	HA12038-01
IC651, 652	5652-HA17082P	HA17082PS
IC752	5652-BA335	BA335
	TRANSISTORS	
Q83,84, 109, 110, 201, 202, 203, 204, 205, 206, 251, 252, 253, 254, 455, 456, 457, 701, 702	5613-2603(F)	2SC2603(F) or 2SC2603(E)
Q101, 102	5613-2855(E)	2SC2855(E) or 2SC2855(D)
Q103, 104	5611-1190(E)	2SA1190(E) or 2SA1190(D)
Q105, 106	5613-2320L(F)	2SC2320L(F)
Q107, 108	5611-999L(F)	2SA999L(F)
Q111, 355, 356, 501, 561	5611-966(Y)	2SA966(Y)
Q112, 357, 358	5613-2236(Y)	2SC2236(Y)
Q255	5611-1115(F)	2SA1115(F) or 2SA1115(E)
Q351, 352	5613-2320(F)	2SC2320(F)
Q353, 354	5611-999(F)	2SA999(F)
Q451, 452, 453, 454	5616-246(GR)	F.E.T., 2SK246(GR)
Q458, 459	5613-2878(B)	2SC2878(B)
Q651, 652	5613-3246(H)	2SC3246(H)
	DIODES	
D101, 102, 501, 561	5635-HZ11B2L	Zener, HZ11B2L
D251, 254, 455, 456, 457, 651, 652, 653, 654	5631-1S2473	1S2473
D252, 253	5636-MC921	MC921
D451, 452, 453, 454	5635-RD5R1EB2	Zener, RD5.1EB2
D562, 563	5635-RD5R6EB2	Zener, RD5.6EB2
D751	5635-RD10EB2	Zener, RD10EB2
	COILS	
L101, 102, 203, 204	5932-70116	
L201, 202	5932-70323	2.7mH
L205, 206	5932-70115	
L501, 502, 561, 562	5932-70215	
L651, 652	5933-70123	
	MISCELLANEOUS	
OS101	6171-0103	Complex, Record Bias Osc.
SW406	4422-70111	Remote Switch, Tape Monitor
J1/2/3/4	4484-24	4-Pin Jack, Line Input, Line Output
J151, 152	4452-0110	Jack, Microphones
P201	4443-040185	Connector, 4 Pos.
P202, 251, 301, 502, 551, 601	4443-030185	Connector, 3 Pos.
P451	4443-100185	Connector, 10 Pos.
P501, 503	4443-034116	Connector, 3 Pos.
J809	4163-071002	Connector with Lead Wire, 7 Pos.
	2132-5049	Spacer, D501, 561

Ref. No.	Part No.	Description
	PCB-2 LOGIC CONTROL P.C. BOARD	
	RESISTORS	
R20, 27	5102-4R74713	4.7Ω, ±2%, 1/4W, Fuse
	CAPACITORS	
C3	5345-478D0962	4700μF, ±20%, 25V, Electrolytic
C4	5345-228D041	2200μF, ±20%, 25V, Electrolytic
C5, 6, 11, 13, 51	5345-477C041	470μF, ±20%, 16V, Electrolytic
C7	5341-109D0958	10000μF, ±20%, 25V, Electrolytic
C8, 9	5352-684571	0.68μF, ±5%, 63V, Metalized Polyester
C14	5345-107C041	100μF, ±20%, 16V, Electrolytic
C52	5345-476D041	47μF, ±20%, 25V, Electrolytic
C53	5345-475D041	4.7μF, ±20%, 25V, Electrolytic
C54	5345-106D041	10μF, ±20%, 25V, Electrolytic
C802	5342-475D0951	4.7μF, ±20%, 25V, Electrolytic
C901	5345-474F041	0.47μF, ±20%, 50V, Electrolytic
	INTEGRATED CIRCUITS	
IC1	5653-T78012AP	TA78012AP
IC801	5653-BA6109	BA6109
IC851	5654-58846-41	M58846-641SP
IC852	5654-TD62503P	TD62503P
IC901	5654-TC4001BP	TC4001BP
	TRANSISTORS	
Q1, 9	5611-1217(Y)	2SA1217(Y)
Q2, 11	5613-2877(Y)	2SC2877(Y)
Q3	5616-2SK381(D	F.E.T., 2SK381(D)
Q4, 10, 807, 851, 852, 853, 854, 855, 856, 903, 905	5611-1115(F)	2SA1115(F) or 2SA1115(E)
Q5, 801, 802, 803, 808, 809	5613-3246(H)	2SC3246(H)
Q6, 812, 813	5611-1286(H)	2SA1286(H)
Q7, 8, 12, 13, 804, 805, 806, 810, 811, 857, 901, 904	5613-2603(F)	2SC2603(F) or 2SC2603(E)
Q51, 91, 94	5611-1115(E)	2SA1115(E) or 2SA1115(F)
Q52, 92, 93	5613-2603(E)	2SC2603(E) or 2SC2603(F)
Q902	5611-1305(Y)	2SA1305(Y)
	DIODES	
D1, 2	5632-1SR35-10	1SR35-10
D3	5685-1F	Bridge Silicon, S1RBA
D4, 5	5635-RD9R1EB2	Zener, RD9.1EB2
D6	5635-RD8R2EB1	Zener, RD8.2EB1
D8, 9	5641-KB265	Varistor, KB265 or MV-12
D10	5635-RD12EB1	Zener, RD12EB1
D51,55,56,57,58,59,90,91, 92, 93, 95, 96, 97, 98, 801, 802, 805, 806, 808, 809, 810, 856, 859, 860, 861, 862, 863, 864, 865, 866, 873, 902, 903, 904	5631-1S2473	1S2473
D52	5635-RD13EB2	Zener, RD13EB2
D53, 54	5631-1S2471	1S2471
D803	5635-RD8R2EB3	Zener, RD8.2EB3
D804	5635-RD6R2EB2	Zener, RD6.2EB2
D807	5635-RD4R7EB2	Zener, RD4.7EB2

Ref. No.	Part No.	Description
	MISCELLANEOUS	
X851	5693-CSB457	Crystal, Osc.
F2, 3	5732-402031	Fuse, 4A, 125V
"	5732-40202	Fuse, 4A, 250V (for General model)
P801	4443-067114	Connector, 6 Pos.
P802	4443-107114	Connector, 10 Pos.
P803	4443-097114	Connector, 9 Pos.
P804	4443-030185	Connector, 3 Pos.
P805	4443-080185	Connector, 8 Pos.
P806	4443-050185	Connector, 5 Pos.
P807	4443-060185	Connector, 6 Pos.
P808	4443-104116	Connector, 10 Pos.
P809	4443-074116	Connector, 7 Pos.
	4472-414	Fuse Holder (x4)
	2132-7048	Spacer, R13, 810, 811, 832, 835, D1, 2, 6
	2132-7049	Spacer, R20, 27, 836, 837
	2132-5049	Spacer, R833, 834
	PCB-3 VR P.C. BOARD	
	RESISTORS	
R191, 192	5102-1814715	180Ω, ±2%, 1/4W, Fuse
R428	5173-270571	27Ω, ±5%, 2W, Metal
	CONTROLS	
VR151/152	5113-20371140	20kΩA, Mic Level
VR161, 162	5113-2038321	20kΩA, Rec Level Left/Right
VR301/302	5113-5027F40	5kΩA, Output Level
VR401, 402	5101-20371920	20kΩB
	CAPACITORS	
C161, 162	5345-106C0952	10μF, ±20%, 16V, Electrolytic
C163, 164	5359-2215851	220pF, ±5%, 100V, Polypropylene
C165, 166	5345-106C0951	10μF, ±20%, 16V, Electrolytic
C167, 168	5359-1015851	100pF, ±5%, 100V, Polypropylene
C169, 170	5345-226C0951	22μF, ±20%, 16V, Electrolytic
C171, 172	5359-1025851	1000pF, ±5%, 100V, Polypropylene
C177, 178, 413, 414	5345-476C041	47μF, ±20%, 16V, Electrolytic
C403, 404	5345-475D041	4.7μF, ±20%, 25V, Electrolytic
C405, 406	5345-335F041	3.3μF, ±20%, 50V, Electrolytic
C411, 412	5345-226C041	22μF, ±20%, 16V, Electrolytic
C415	5345-227C041	220μF, ±20%, 16V, Electrolytic
	INTEGRATED CIRCUIT	
IC401	5652-M5218P	M5218P
	TRANSISTORS	
Q81, 82	5613-2878(B)	2SC2878(B)
Q161, 162, 165, 166	5613-2320L(F)	2SC2320L(F)
Q163, 164	5611-999L(F)	2SA999L(F)
Q167, 168, 169, 170, 401, 402, 403, 404, 405, 406	5613-2603(F)	2SC2603(F)
Q407	5613-2236(Y)	2SC2236(Y)
	DIODES	
D161, 162	5635-RD10EB2	Zener, RD10EB2
D401, 402, 403, 404	5631-1K34A	1K34A
D405	5635-RD7R5EB2	Zener, RD7.5EB2
D701	5631-1S2473	1S2473
	MISCELLANEOUS	
LC161, 162	5214-51	LC Components
SW301/302	4431-02047364	Push Switch, Rec Mute, Auto Space
P401	4443-070185	Connector, 7 Pos.
J402	4163-072002	Connector with Lead Wire, 7 Pos.
J501	4163-70296	Connector with Lead Wire, 3 Pos.
J503	4163-70396	Connector with Lead Wire, 3 Pos.
	2132-5049	Spacer, R425

Ref. No.	Part No.	Description
	PCB-4 PUSH SWITCHES P.C. BOARD	
	DIODES	
D201, 202, 203, 204, 205, 206, 411, 867, 868, 869, 870, 872	5631-1S2473	1S2473
D409	5637-GL5HD22	L.E.D., GL5HD22, Red, Tape Monitor
	MISCELLANEOUS	
SW201, 202, 203, 401, 402, 403, 801, 802, 803	4431-0918716	Push Switch, Bias/Equalization, Dolby NR/Type, MPX Filter, Timer
SW204, 205, 901, 902, 903	4431-A027136	Push Switch, Peak Hold, Meter Weighting, Memory, Auto Rewind/Replay
SW404, 405, 904, 905, 906	4431-A027236	Push Switch, Bias Tone, Rec. Cal, Reset, Time, Count
J803	4163-094502	Connector with Lead Wire, 9 Pos.
	2132-01401	Spacer, D409
	PCB-5 KEY SWITCHES P.C. BOARD	
	DIODES	
D851	5637-SY406TK	L.E.D., SY406TK, Yellow, Pause
D852	5637-TLR122	L.E.D., TLR122, Red, Record
D853, 854, 855	5637-TLG121	L.E.D., TLG121, Green, F.FWD, Play, Rew.
D857, 858	5631-1S2473	1S2473
	MISCELLANEOUS	
SW101, 102, 103, 104, 105, 106	4431-A017140	Push Switch, Rew, Play, F.FWD, Stop, Record, Pause
	PCB-6 MASTER FADER P.C. BOARD	
VR163/164	5113-10371141	Control, 10kΩA, Master Fader
	PCB-7 HEADPHONES JACK P.C. BOARD	
J351	4451-00141	Jack, Headphones
	PCB-8 POWER SWITCH P.C. BOARD	
C1	5361-1030419	Capacitor, 0.01μF, +100% −0%, AC125V, Ceramic
"	5352-1030958	Capacitor, 0.01μF, ±20%, AC250V, Metalized Polyester (for General model)
SW1	4431-A01056	Push Switch, Power
	PCB-9 REC. CAL P.C. BOARD	
VR201, 202	5101-2228074	Control, 2.2kΩ, Rec. Cal Left/Right
	PCB-10 DOLBY NR INDICATORS P.C. BOARD	
D407	5637-GL9PG19	L.E.D., GL9PG10, Green, Dolby B
D408	5637-GL9HY9	L.E.D., GL9HY9, Yellow, Dolby C
	PCB-11 LAMP P.C. BOARD	
LP802	5731-0807445	Lamp, Illumination
	PCB-12 TAPE COUNTER P.C. BOARD	
Q906	5613-2603(E)	Transistor, 2SC2603(E) or 2SC2603(F)
D905	5637-LT9002D	L.E.D., LT9002D, Red, Wait
DSP901	5623-SLK2452	LED Display
J808	4163-101802	Connector with Lead Wire, 10 Pos.

Idler KGE 015360A

Direct Drive belt SEE 21549-01

The Harman Kardon Model CD491

Manual 66B

ULTRAWIDEBAND LINEAR PHASE CASSETTE DECK

Technical Manual

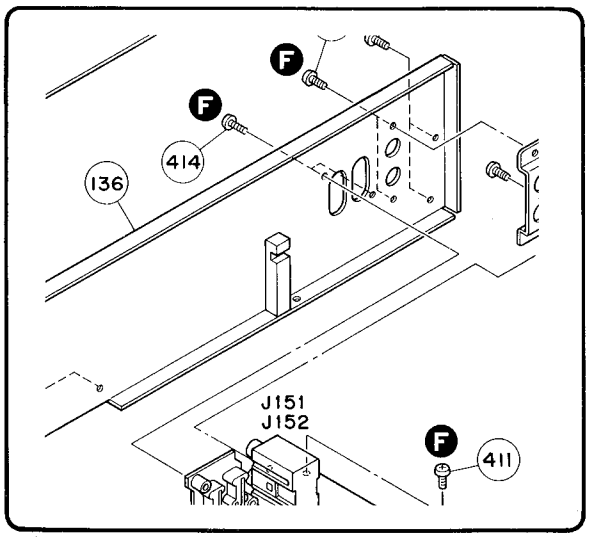
SUPPLEMENTARY MANUAL 1

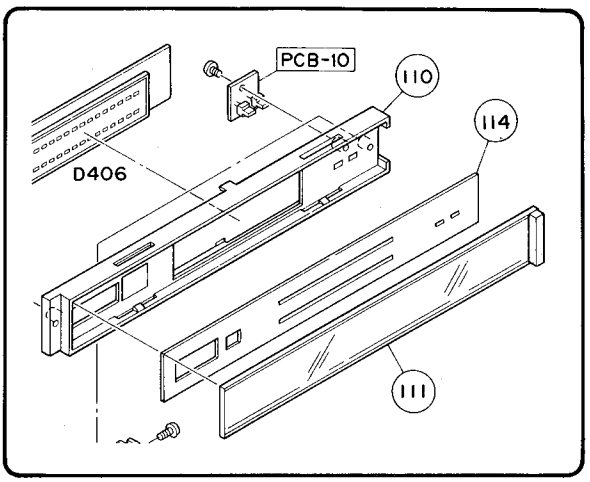
MODIFICATIONS WERE MADE AT SERIAL NUMBER 03301 TO IMPROVE PERFORMANCE. EXCEPT FOR THE CHANGES AS NOTED IN THIS SUPPLEMENT, REFER TO MANUAL 66A FOR ALL OTHER PARTS AND SERVICE INFORMATION.

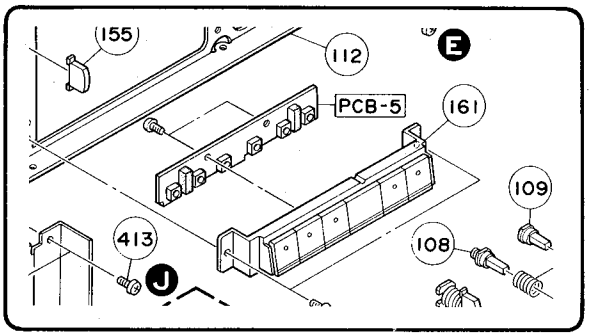
harman/kardon
240 Crossways Park West, Woodbury, N.Y. 11797
1112-H15266B1 P-088503 1650 Printed in Japan

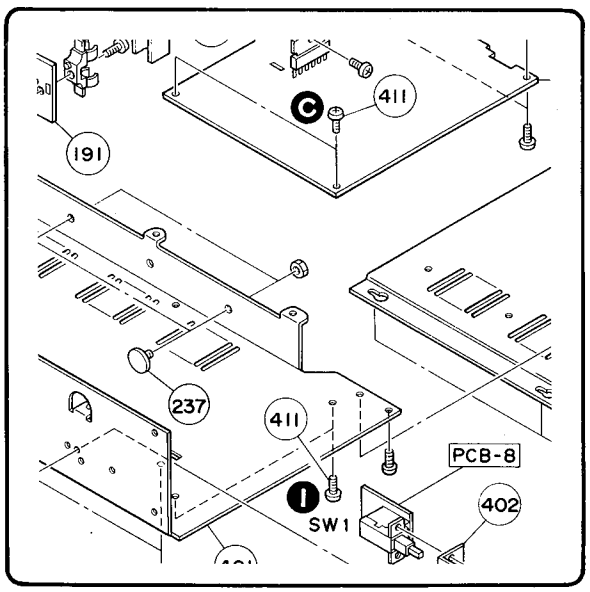
CD491

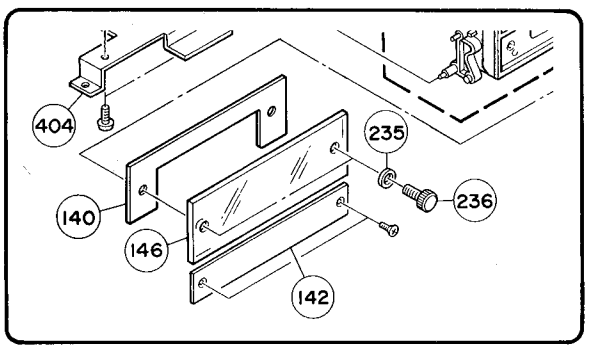
GENERAL UNIT EXPLODED VIEW











GENERAL UNIT PARTS LIST

MARKETS

U	: U.S.A. model	GM	: General model Military version
A	: Canada model	B	: Australia model
G	: General model	GB	: General model Black Face version
		GBM	: General model Military Black Face version

Ref. No.	Part No.	Description
102	1424-09201	Cabinet Bottom (GM, GMB, B)
103	A443-CD491A	Front Panel Assembly (U, A, G, GM, B)
103	A443-CD491C	Front Panel Assembly (GB, GMB)
105	A630-CD491A	Knob Assembly, Master Fader (U, A, G, GM, B)
105	A630-CD491B	Knob Assembly, Master Fader (GB, GMB)
113	C112-CD491A	Cassette Tape Recorder Mechanical Assembly (U, A, G, GM, B)
113	C112-CD491B	Cassette Tape Recorder Mechanical Assembly (GB, GM)
114	A513-CD491A	Plate Assembly, L.E. D.
136	A424-CD491K	Cabinet Back Assembly (U, A)
136	A424-CD491L	Cabinet Back Assembly (G, GB, GM, GMB, B)
136	A424-CD491P	Cabinet Back Assembly (B)

Ref. No.	Part No.	Description
140	1511-02601	Plate, Cassette Compartment Cover (U, A, G, GM, B)
140	1511-02602	Plate, Cassette Compartment Cover (GB, GMB)
142	1513-05101	Dressing Plate (U, A, G, GM, B)
142	1513-05103	Dressing Plate (GB, GMB)
152	1630-01901	Knob, Output Level, Mic. Level, Rec. Level (U, A, G, GM, B)
152	A634-CD491A	Knob Assembly, Output Level, Mic. Level, Rec. Level (GB, GMB)
153	1634-02701	Knob, Bias Fine Trim (U, A, G, GM, B)
153	1634-02702	Knob, Bias Fine Trim (GB, GMB)
161	3351-015	Push Button Assembly, Cassette Mechanism Control (U, A, G, GM, B)
161	3351-016	Push Button Assembly, Cassette Mechanism Control (GB, GMB)
181	2219-7093	Bracket (for U, A)
191	2224-7061	Insulator (for U, A)
192	2240-7118	Holder (for U, A)
198	2240-7120	Holder (Except U, A)
236	2310-7025	Special Screw (U, A, G, GM)
236	2310-7026	Special Screw (GB, GMB)
237	2310-7027	Special Screw
307	2440-7017	Special Nut (for G)
401	2211-7245	Chassis, Left (Except U, A)
407	2219-7963	Bracket, T1 (Except U, A)
411	2347-300627	Bind Head Tapping Screw (GB)
412	2347-300827	Bind Head Tapping Screw (G, GB, GMB)
	1111-J30148	Owner Guide (Except U)
	4474-29	AC Adaptor (For GM, GMB)

CASSETE MECHANISM PARTS LIST

Ref. No.	Part No.	Description
538	A614-CD491A	Cassette Compartment Slot Assembly (U, A, G, GM, B)
538	A614-CD491C	Cassette Compartment Slot Assembly (GB, GMB)

ELECTRICAL PARTS LIST

Ref. No.	Part No.	Description
	CHASSIS MISCELLANEOUS	
⚠P1	4161-7256	Power Cord (G, GB, GM, GMB)
⚠P1	4161-71185	Power Cord (B)
⚠T1	5584-702434	Power Transformer (G, GB, GM, GMB, B)
⚠F1	5732-402031	Fuse, 4A, 125V (for U, A)
	4472-0125	Fuse Holder (for U, A)
	PCB-1 MAIN P.C. BOARD	
	RESISTORS	
⚠R465, 466	5102-1014715	100Ω, ±2%, 1/4W, Fuse
⚠R557, 610	5102-1004715	10Ω, ±2%, 1/4W, Fuse
	CAPACITORS	
C119, 120	5353-270534	27pF, ±5%, 500V, Mica
C253	5342-225F0951	2.2μF, ±20%, 50V, Electrolytic
C254	5345-226C041	22μF, ±20%, 16V, Electrolytic
C527, 528, 587, 588, 615, 616	5345-226C0951	22μF, ±20%, 16V, Electrolytic
C553, 613	5345-228C0962	2200μF, ±20%, 16V, Electrolytic
C661, 662	5359-5615041	560pF, ±5%, 100V, Polypropylene
	TRANSISTORS	
Q351, 352	5613-2603(F)	2SC2603(F)
Q353, 354	5611-1115(F)	2SA1115(F) or 2SA1115(E)
Q458, 459	5613-945L(K)	2SC945L(K) or 2SC945L(P)
Q502, 562	5613-2236(Y)	2SC2236(Y)

Ref. No.	Part No.	Description
	DIODES	
D103, 104, 502, 564	5641-KB265	Varistor, KB265
D255	5631-1S2473	1S2473
D562, 563	5635-RD5R6JB2	Zener, RD5.6JB2
D751	5635-RD11JB2	Zener, RD11JB2
	COILS	
L201, 202	5932-70223	3.3mH
L751	5597-35502	Ferrite Bead
	MISCELLANEOUS	
J1/2/3/4	4484-24	4-Pin Jack, Input, Output (U.S.A., Canada & General models)
J1/2/3/4	4484-41	4-Pin Jack, Input, Output (General model Black Face & General model Military Black Face versions)
P301, 502, 551, 601	4443-037114	Connector, 3 Pos.
	PCB-2 LOGIC CONTROL P.C. BOARD	
	CAPACITORS	
C4	5345-478D0962	4700μF, ±20%, 25V, Electrolytic
C52	5345-475D041	4.7μF, ±20%, 25V, Electrolytic
C53	5345-476D041	47μF, ±20%, 25V, Electrolytic
C863	5345-226C0951	22μF, ±20%, 16V, Electrolytic
	DIODES	
D4, 5	5635-RD9R1JB2	Zener, RD9.1JB2
D6	5635-RD8R2JB1	Zener, RD8.2JB1
D10	5635-RD12JB1	Zener, RD12JB1
D11	5631-1S2473	1S2473
D803	5635-RD8R2JB3	Zener, RD8.2JB3
D804	5635-RD6R2JB2	Zener, RD6.2JB2
D807	5635-RD4R7JB2	Zener, RD4.7JB2
	MISCELLANEOUS	
L851	5597-35502	Ferrite Bead
	PCB-3 VR P.C. BOARD	
	CONTROLS	
VR151/152	5113-50272140	5kΩA, Mic. Level
VR301/302	5113-50271150	5kΩA, Output Level
	TRANSISTORS	
Q81, 82	5613-945L(K)	2SC945L(K) or 2SC945L(P)
	DIODES	
D161, 162	5635-RD10JB2	Zener, RD10JB2
D405	5635-RD7R5JB2	Zener, RD7.5JB2
	MISCELLANEOUS	
J502	4163-70696	Connector with Lead Wire, 3 Pos.
J551	4163-70796	Connector with Lead Wire, 3 Pos.
	PCB-6 MASTER FADER P.C. BOARD	
VR163/164	5113-10397122	Control, 10kΩA, Master Fader
J601	4163-70496	Connector with Lead Wire, 3 Pos.
	PCB-7 HEADPHONES JACK P.C. BOARD	
J301	4163-70596	Connector with Lead Wire, 3 Pos.
	PCB-8 POWER SWITCH P.C. BOARD	
⚠C1	5352-1030958	Capacitor, 0.01μF, ±20%, AC250V, Metalized Polyester (Except U.S.A. & Canada models)
	PCB-10 DOLBY NR INDICATORS P.C. BOARD	
D407	5637-GL9HY9	L.E.D., GL9HY9, Yellow, Dolby NR C
D408	5637-GL9PG19	L.E.D., GL9PG19, Green, Dolby NR B

⚠ SAFETY RELATED COMPONENT. USE ONLY EXACT REPLACEMENT PART AS SPECIFIED.

SCHEMATIC DIAGRAM

PLAYBACK AMP.

DOLBY NR SECTION (PLAYBACK)

PEAK LEVEL METER

HEADPHONE AMP.

SCAN AMP.

LINE & MIC. AMP.

RECORDING AMP.

DOLBY NR SECTION (RECORD)

HX-PRO CIRCUIT

REC. CAL. & BIAS TONE OSC.

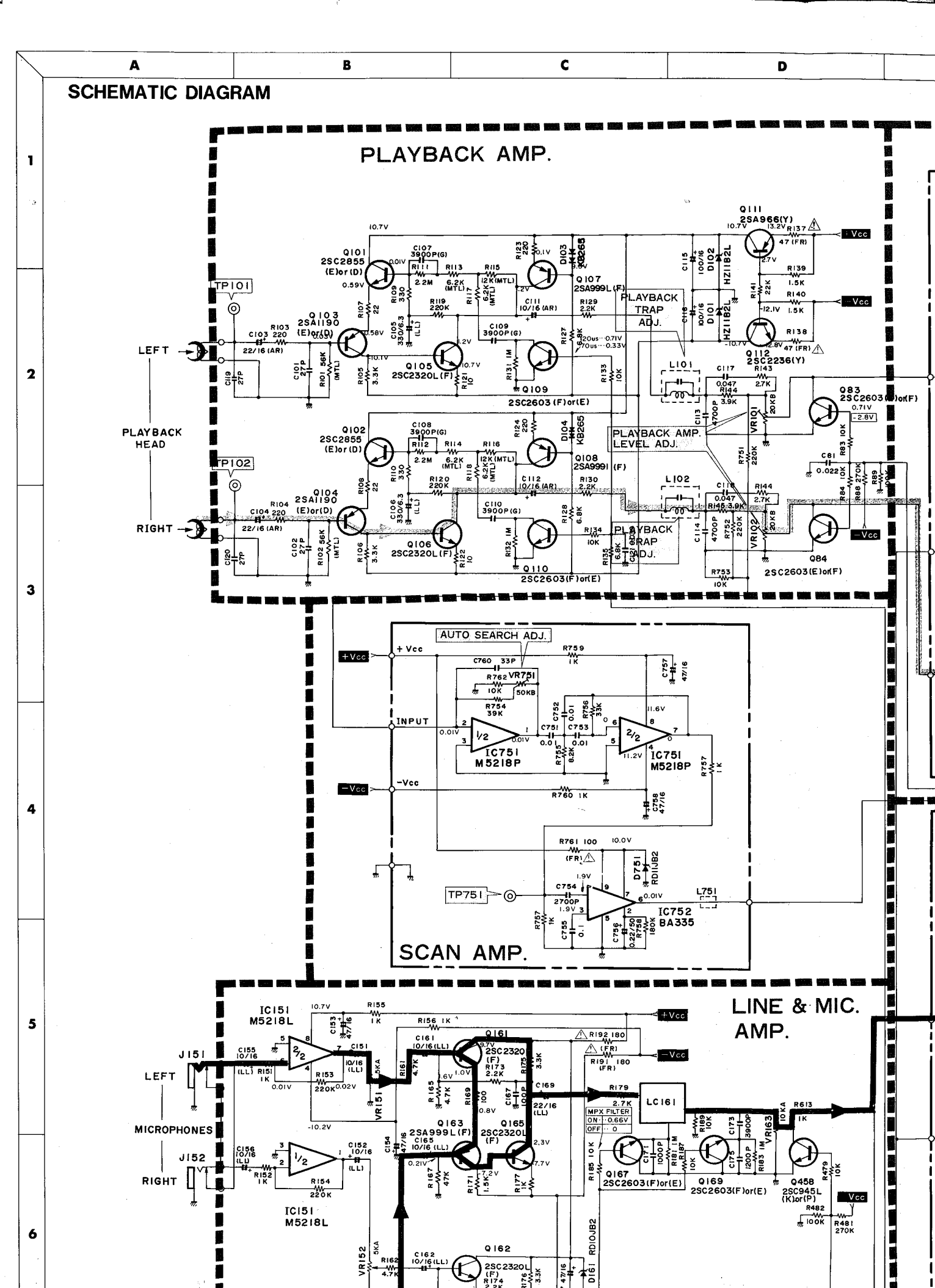
MICRO COMPUTER CONTROLLED PROCESSER BLOCK

POWER SUPPLY

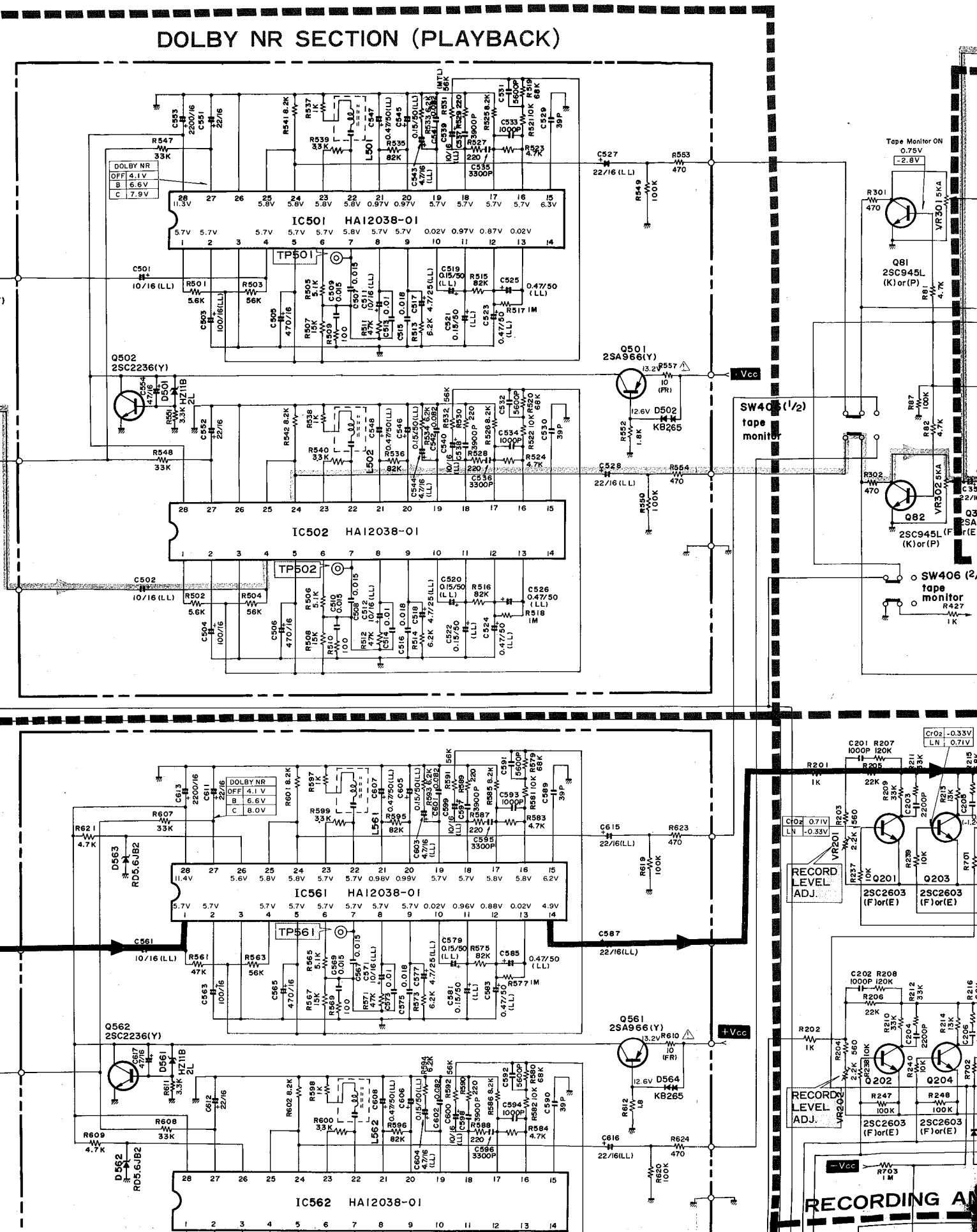
..... RECORDING SIGNAL (Lch)
..... PLAYBACK SIGNAL (Rch)
..... HX-PRO SIGNAL

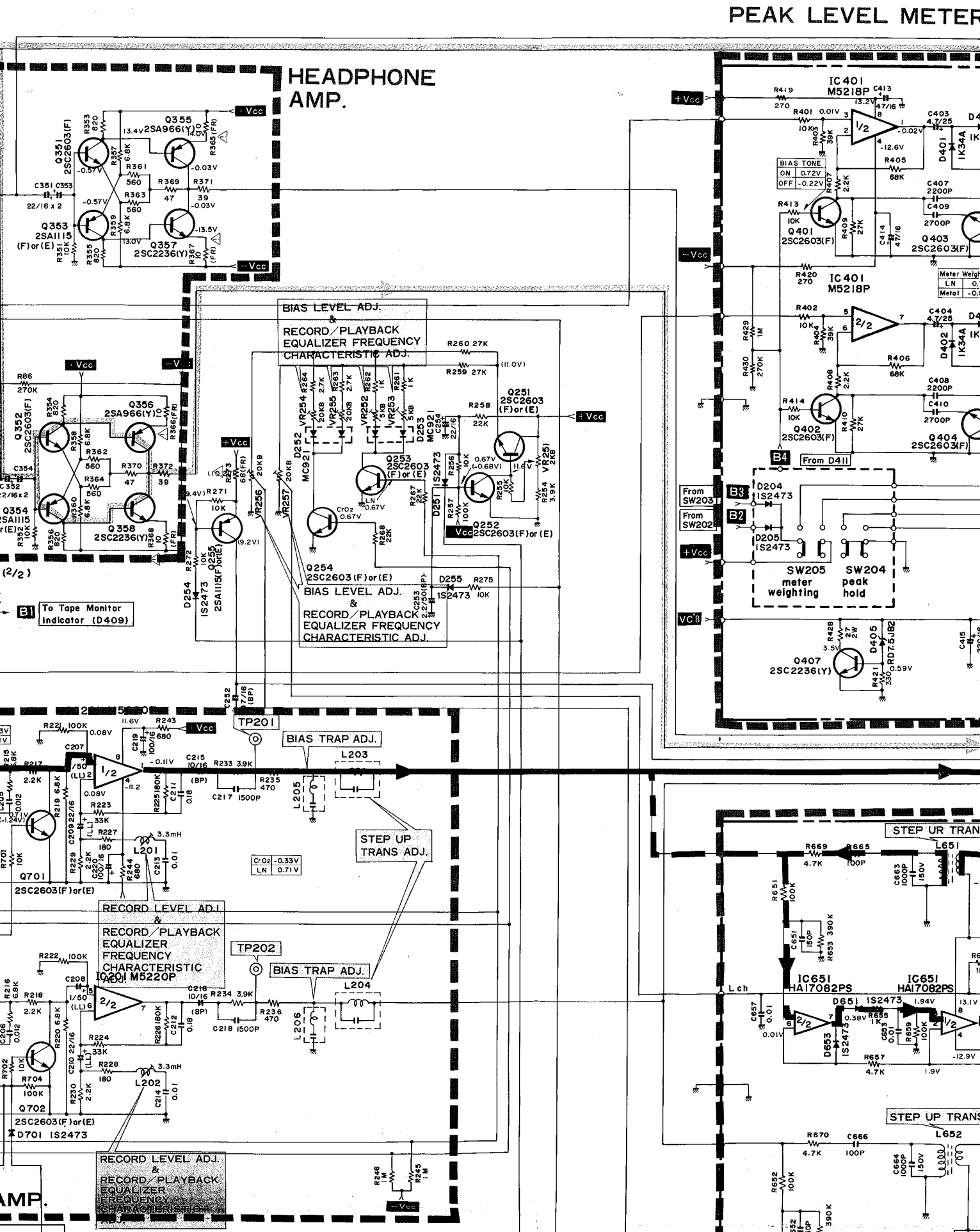
1. ALL RESISTANCES VALUES ARE IN Ω.
kΩ= 1000Ω, MΩ= 1000kΩ
2. THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCES VALUES ARE IN μF UNLESS OTHERWISE NOTED. P = μμF
AND ALL ELECTRICAL CAPACITANCES VOLTAGE VALUES ARE GIVEN WITHOUT UNIT. THE OMITTED UNIT IS V. 47/50 → 47μF/50V
4. V: DC VOLTAGE AT NO SIGNAL
. . . V STOP MODE
. . . V PLAYBACK MODE
(. . . V) RECORDING MODE
5. ⚠ SAFETY-REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS. THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.

SCHEMATIC DIAGRAM



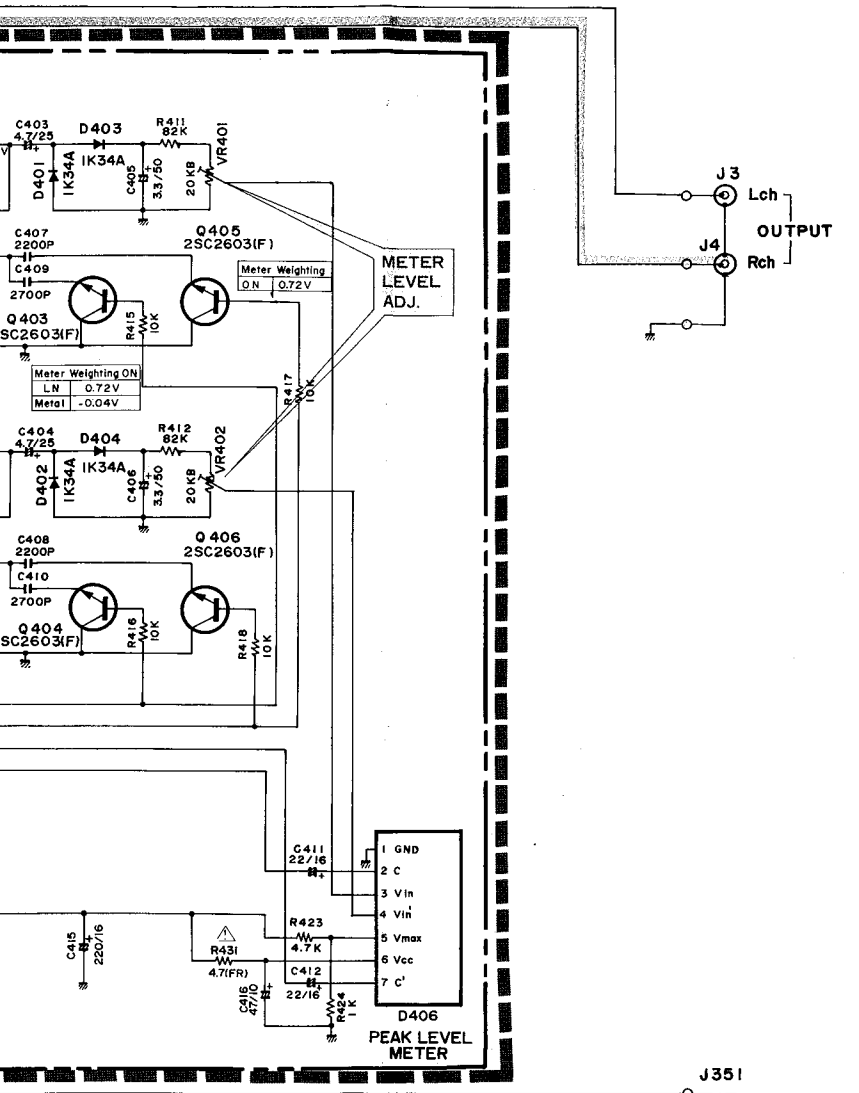
DOLBY NR SECTION (PLAYBACK)

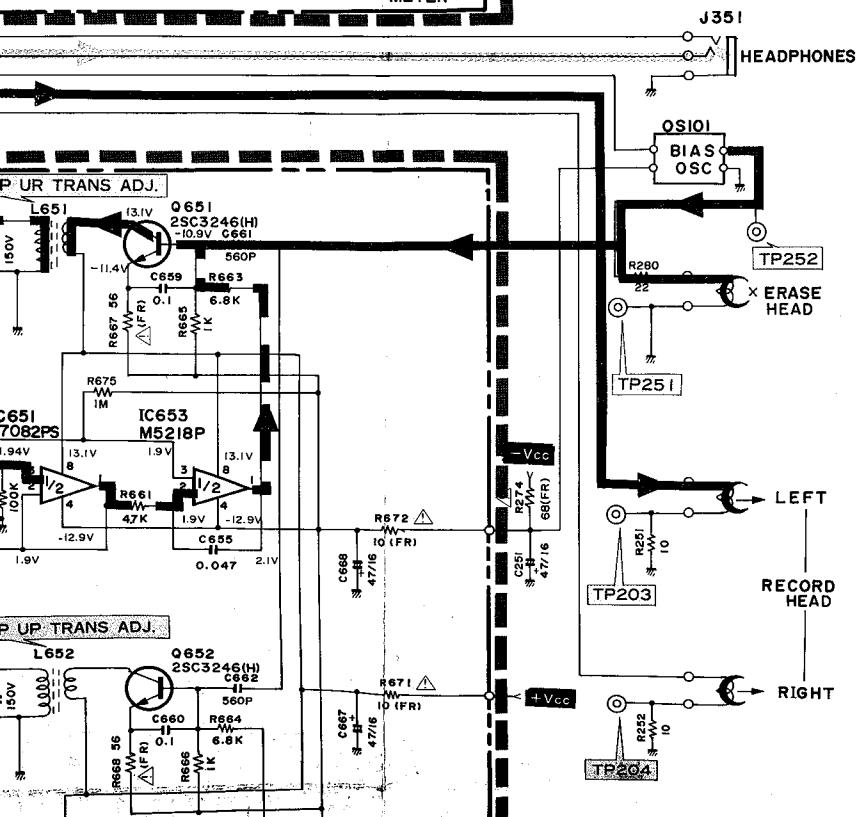


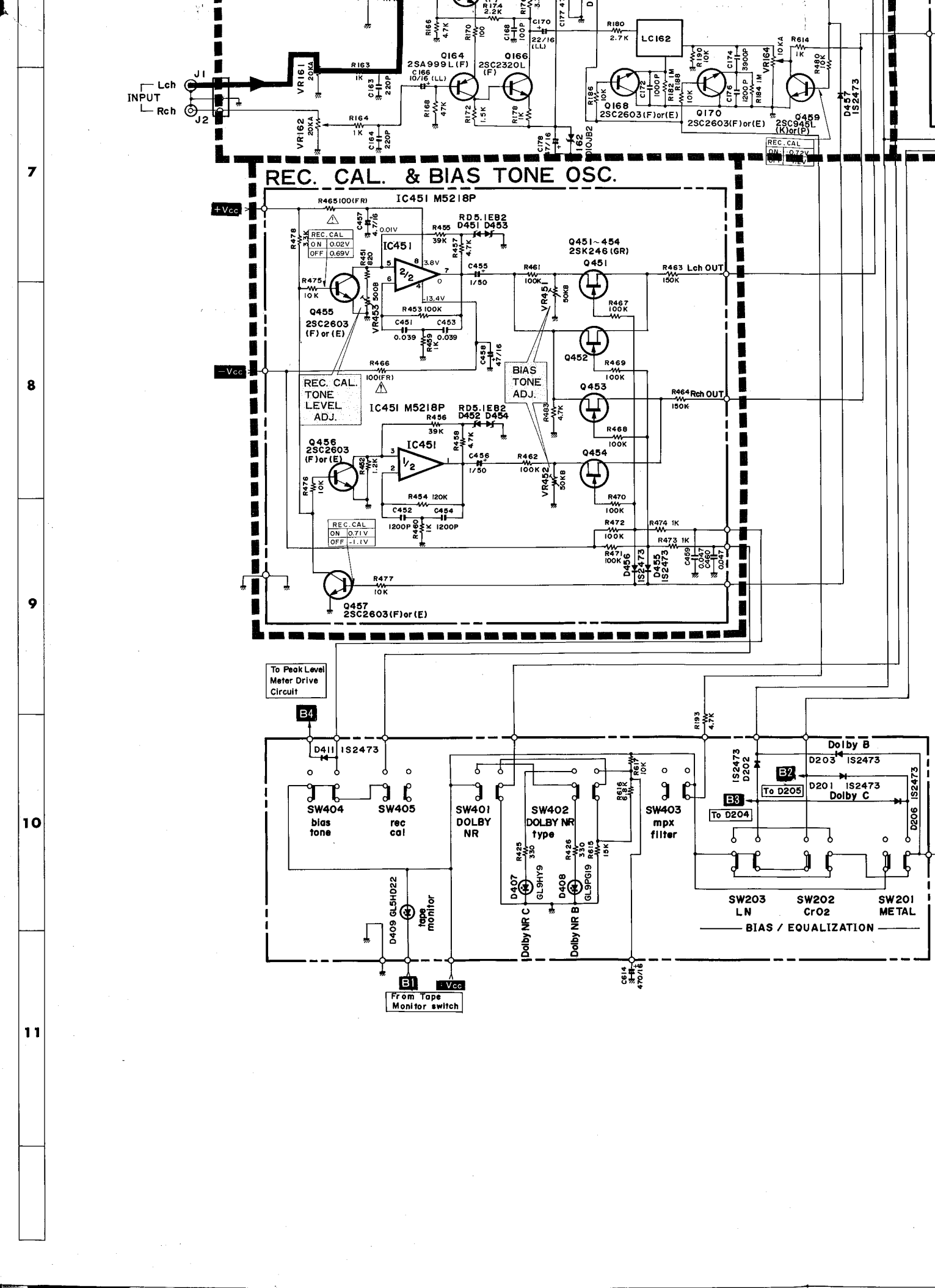

PEAK LEVEL METER
HEADPHONE AMP.
+Vcc
-Vcc
IC401 M5218P
Q401 2SC2603(F)
Q402 2SC2603(F)
Q403 2SC2603(F)
Q404 2SC2603(F)
Q407 2SC2236(Y)
BIAS TONE
ON 0.72V
OFF -0.22V
Meter Weigh
LN
Metal
From D411
From SW203
From SW202
SW205 meter weighting
SW204 peak hold
BIAS LEVEL ADJ. & RECORD/PLAYBACK EQUALIZER FREQUENCY CHARACTERISTIC ADJ.
Q251 2SC2603 (F)or(E)
Q252 2SC2603(F)or(E)
Q253 2SC2603 (F)or(E)
Q254 2SC2603(F)or(E)
Q351 2SC2603(F)
Q352 2SC2603(F)
Q353 2SA1115 (F)or(E)
Q354 2SA1115
Q355 2SA966(Y)
Q356 2SA966(Y)
Q357 2SC2236(Y)
Q358 2SC2236(Y)
To Tape Monitor Indicator (D409)
TP201
BIAS TRAP ADJ.
L203
L205
STEP UP TRANS ADJ.
Q701 2SC2603(F)or(E)
L201
RECORD LEVEL ADJ. & RECORD/PLAYBACK EQUALIZER FREQUENCY CHARACTERISTIC ADJ.
IC201 M5220P
TP202
BIAS TRAP ADJ.
L204
L206
Q702 2SC2603(F)or(E)
D701 1S2473
L202
RECORD LEVEL ADJ. & RECORD/PLAYBACK EQUALIZER FREQUENCY CHARACTERISTIC ADJ.
IC651 HA17082PS
Lch
D651 1S2473
STEP UR TRAN
L651
STEP UP TRANS
L652

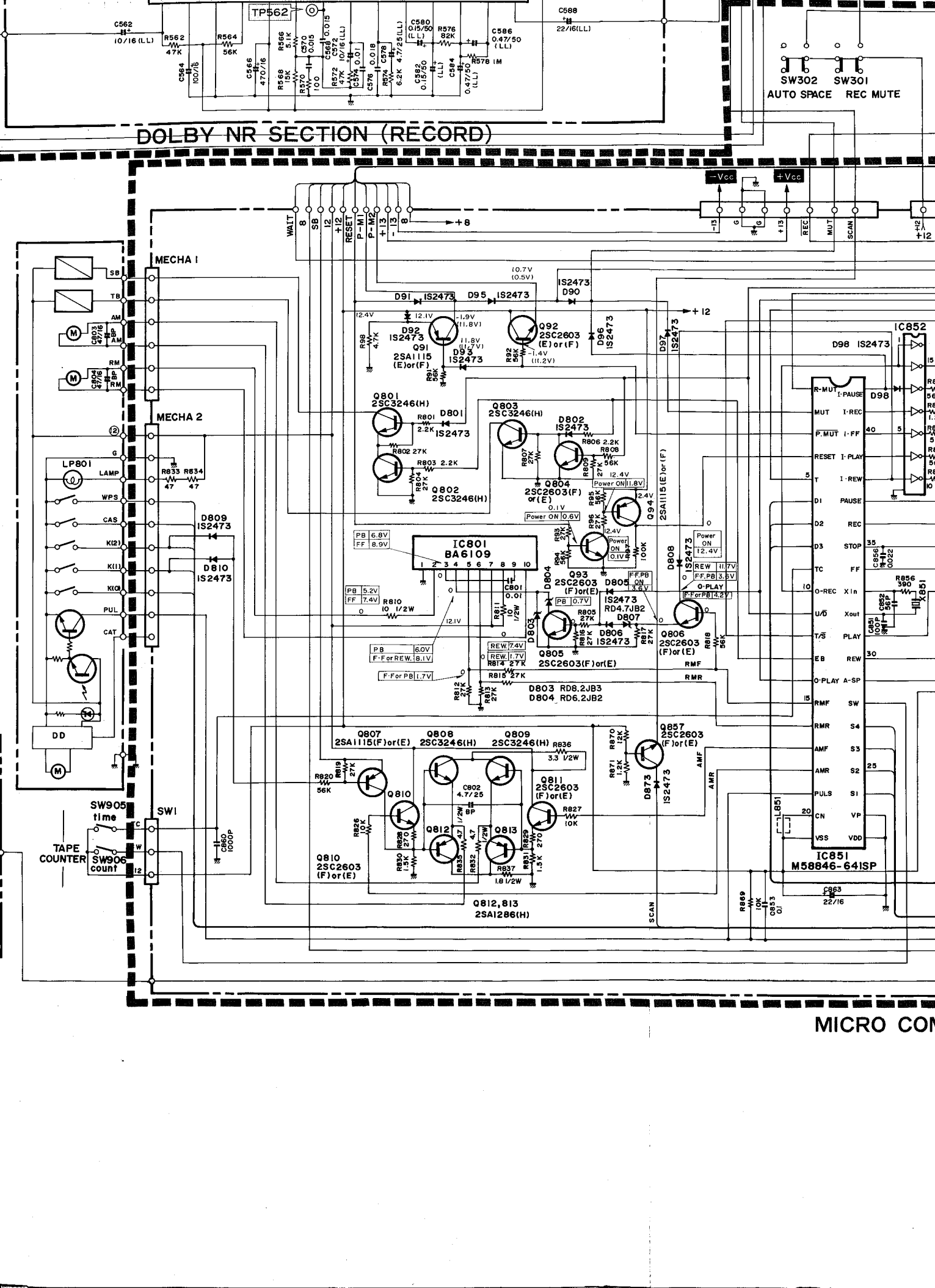
M	N	O	P

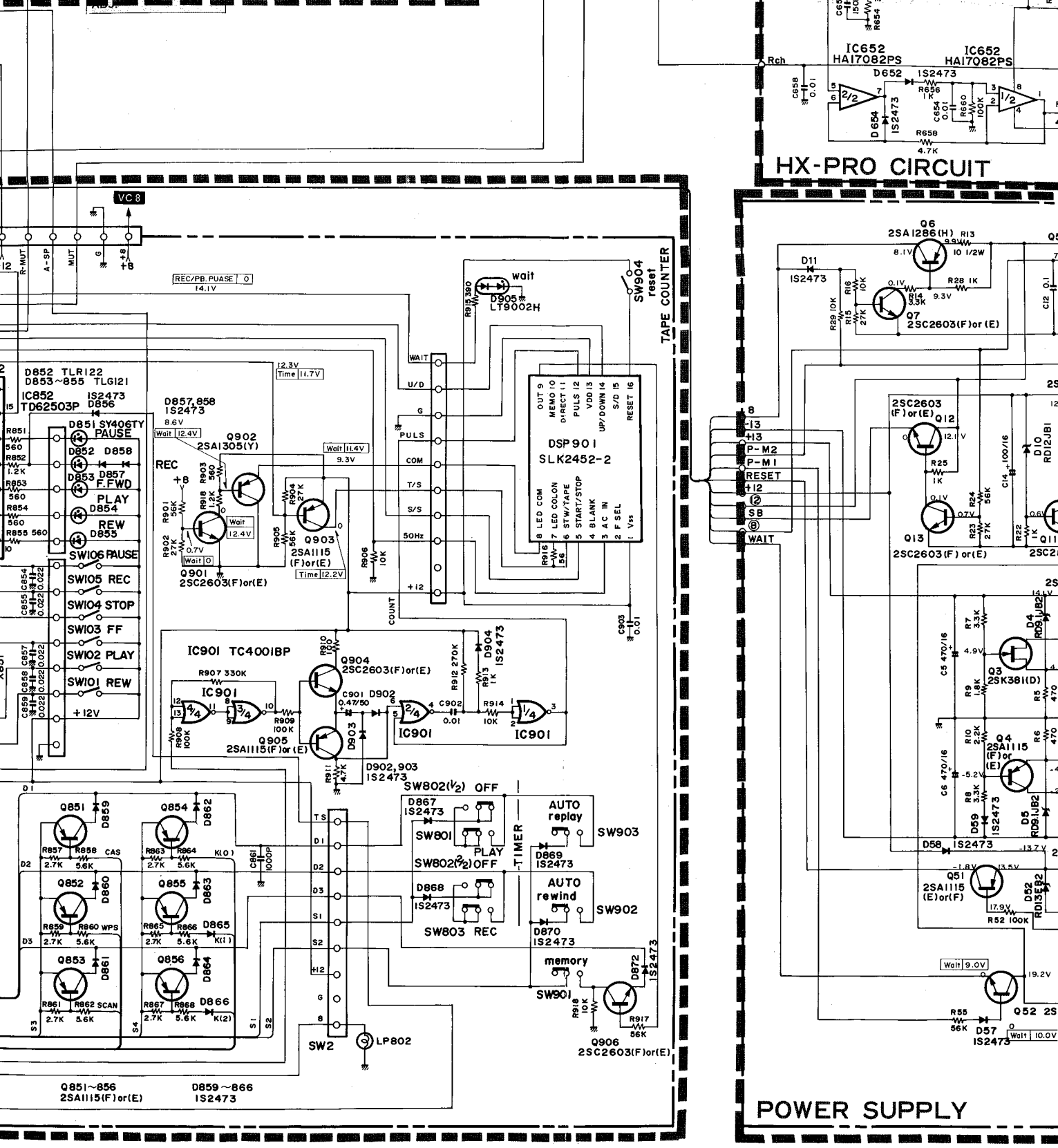
ETER

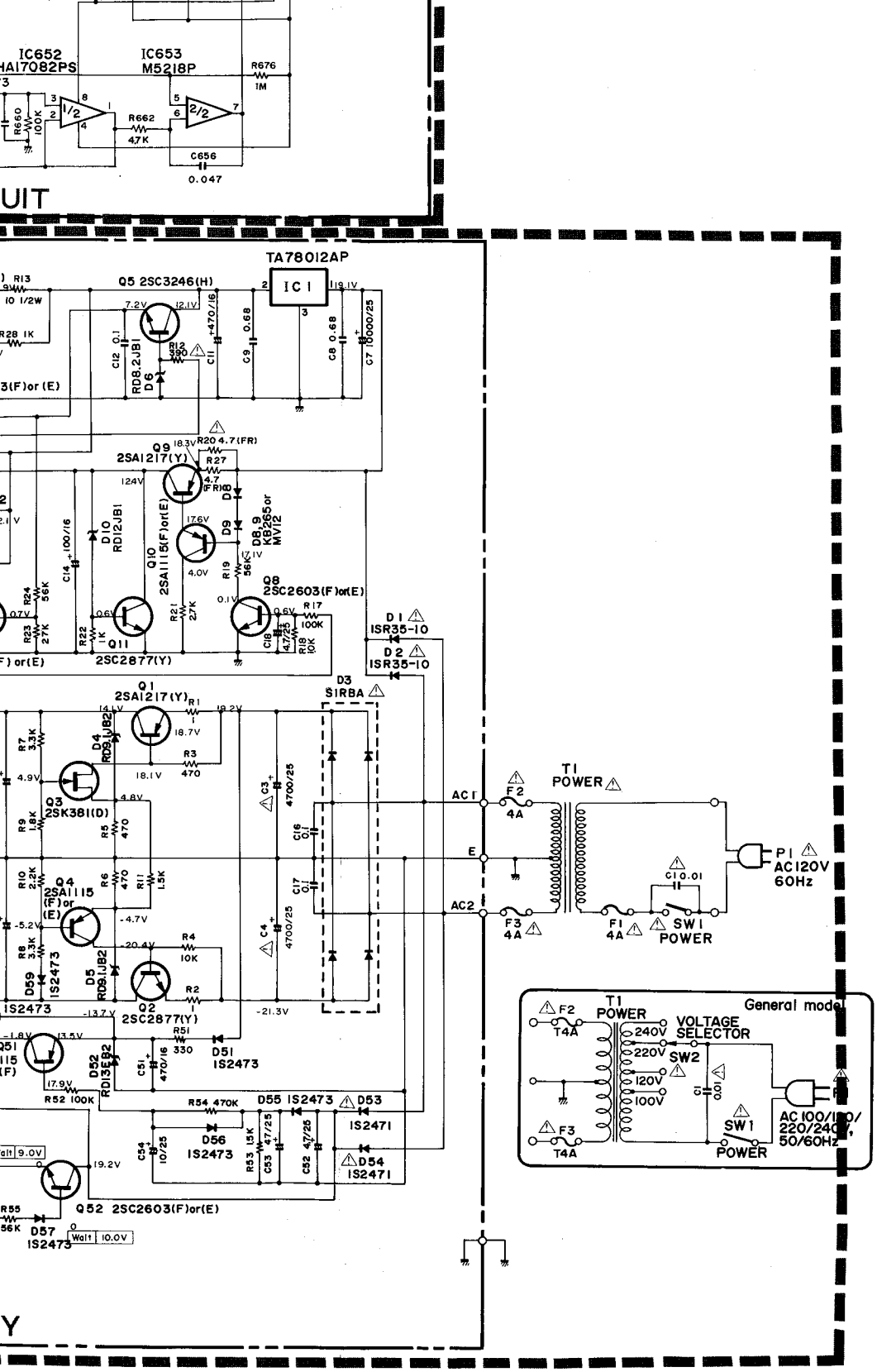

C403 4.7/25
D403
R411 82K
VR401
D401 1K34A
C405 3.3/50
20KB
C407 2200P
C409 2700P
Q405 2SC2603(F)
Meter Weighting
ON 0.72V
METER LEVEL ADJ.
Q403 SC2603(F)
R415 10K
Meter Weighting ON
LN 0.72V
Metal -0.04V
R417 10K
C404 4.7/25
D404
R412 82K
VR402
D402 1K34A
C406 3.3/50
20KB
C408 2200P
C410 2700P
Q406 2SC2603(F)
Q404 SC2603(F)
R416 10K
R418 10K
C411 22/16
1 GND
2 C
3 Vin
4 Vin'
5 Vmax
6 Vcc
7 C'
C415 220/16
R423 4.7K
R431 4.7(FR)
C412 22/16
C416 47/10
R424 1K
D406
PEAK LEVEL METER
J3
Lch
OUTPUT
J4
Rch


J351
HEADPHONES
QS101
BIAS OSC
P UR TRANS ADJ.
L651
Q651 2SC3246(H)
C661 560P
C659 0.1
R663 6.8K
R667 56
R665 1K
TP252
R280 22
ERASE HEAD
TP251
R675 1M
IC653 M5218P
C651 7082PS
R661 4.7K
R672 10 (FR)
C655 0.047
-Vcc
R254 68(FR)
C668 47/16
C251 47/16
R251 10
TP203
LEFT
RECORD HEAD
RIGHT
P UP TRANS ADJ.
L652
Q652 2SC3246(H)
C662 560P
C660 0.1
R664 6.8K
R668 56
R666 1K
R671 10 (FR)
+Vcc
C667 47/16
R252 10
TP204


REC. CAL. & BIAS TONE OSC.
IC451 M5218P
+Vcc
-Vcc
REC. CAL. TONE LEVEL ADJ.
BIAS TONE ADJ.
Q451~454 2SK246(GR)
Q455 2SC2603 (F) or (E)
Q456 2SC2603 (F) or (E)
Q457 2SC2603(F)or(E)
Q164 2SA999L(F)
Q166 2SC2320L (F)
Q168 2SC2603(F)or(E)
Q170 2SC2603(F)or(E)
Q459 2SC945L (K)or(P)
LC162
Lch OUT
Rch OUT
Lch INPUT
Rch
J1
J2
To Peak Level Meter Drive Circuit
From Tape Monitor switch
SW404 bias tone
SW405 rec cal
SW401 DOLBY NR
SW402 DOLBY NR type
SW403 mpx filter
SW203 LN
SW202 CrO2
SW201 METAL
BIAS / EQUALIZATION
Dolby B
Dolby C
Dolby NR C
Dolby NR B
tape monitor
B1
B2
B3
B4
To D205
To D204


DOLBY NR SECTION (RECORD)
TP562
SW302 AUTO SPACE
SW301 REC MUTE
-Vcc
+Vcc
WAIT
SB
RESET
P-M1
P-M2
+8
MECHA 1
MECHA 2
LP801
LAMP
WPS
CAS
PUL
CAT
DD
SW905 time
SW906 count
SW1
TAPE COUNTER
IC801 BA6109
IC852
IC851 M58846-641SP
D91 1S2473
D95 1S2473
D90 1S2473
D92 1S2473
D93 1S2473
D96 1S2473
D97 1S2473
D98 1S2473
D801 1S2473
D802 1S2473
D809 1S2473
D810 1S2473
D803 RD8.2JB3
D804 RD6.2JB2
D805 1S2473 RD4.7JB2
D806 1S2473
D807
D808 1S2473
D873 1S2473
Q91 2SA1115 (E)or(F)
Q92 2SC2603 (E)or(F)
Q801 2SC3246(H)
Q802 2SC3246(H)
Q803 2SC3246(H)
Q804 2SC2603(F) or(E)
Q805 2SC2603(F)or(E)
Q806 2SC2603 (F)or(E)
Q807 2SA1115(F)or(E)
Q808 2SC3246(H)
Q809 2SC3246(H)
Q810 2SC2603 (F)or(E)
Q811 2SC2603 (F)or(E)
Q812,813 2SA1286(H)
Q857 2SC2603 (F)or(E)
Q93 2SC2603 (F)or(E)
Q94 2SA1115(E)or(F)
MICRO CON


HX-PRO CIRCUIT
IC652 HA17082PS
IC652 HA17082PS
Rch
D652 IS2473
D654 IS2473
R658 4.7K
VC8
R-MUT
A-SP
MUT
G
+8
REC/PB.PUASE 0
14.1V
wait
D905 LT9002H
SW904 reset
TAPE COUNTER
D852 TLR122
D853~855 TLG121
IC852 TD62503P
IS2473 D856
D851 SY406TY PAUSE
D852 D858
D853 D857 F.FWD
PLAY D854
REW D855
SW106 PAUSE
SW105 REC
SW104 STOP
SW103 FF
SW102 PLAY
SW101 REW
+12V
D857,858 IS2473
Q902 2SA1305(Y)
REC
Q901 2SC2603(F)or(E)
Q903 2SA1115 (F)or(E)
WAIT
U/D
G
PULS
COM
T/S
S/S
50Hz
+12
COUNT
DSP901 SLK2452-2
IC901 TC4001BP
Q904 2SC2603(F)or(E)
Q905 2SA1115(F)or(E)
D902,903 IS2473
SW802(1/2) OFF
SW801 PLAY
SW802(2/2) OFF
SW803 REC
D867 IS2473
D868 IS2473
D869 IS2473
D870 IS2473
AUTO replay
SW903
AUTO rewind
SW902
TIMER
memory
SW901
D872 IS2473
Q906 2SC2603(F)or(E)
SW2
LP802
Q851 D859
Q854 D862
Q852 D860
Q855 D863
Q853 D861
Q856 D864
D865
D866
CAS
K(0)
K(1)
K(2)
WPS
SCAN
Q851~856 2SA1115(F)or(E)
D859~866 IS2473
Q6 2SA1286(H)
D11 IS2473
Q7 2SC2603(F)or(E)
2SC2603 (F)or(E) Q12
Q13 2SC2603(F)or(E)
Q3 2SK381(D)
Q4 2SA1115 (F)or (E)
Q51 2SA1115 (E)or(F)
D58 IS2473
D59 IS2473
D57 IS2473
Q52
P-M2
P-M1
RESET
SB
POWER SUPPLY
OMPUTER CONTROLLED PROCESSER BLOCK



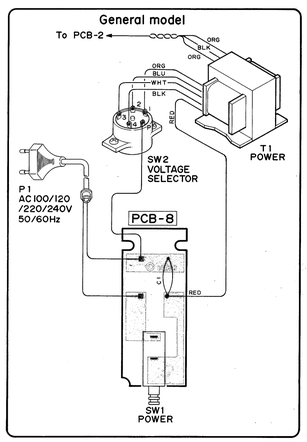
▬▬▬ . . . . . RECORDING SIGNAL (Lch)

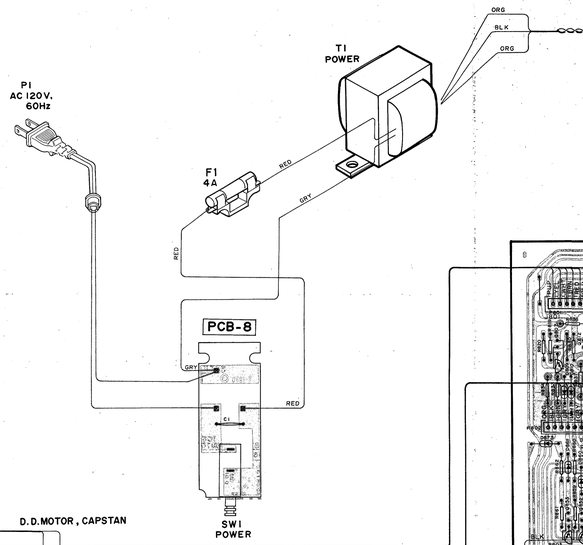
▬▬▬ . . . . . PLAYBACK SIGNAL (Rch)

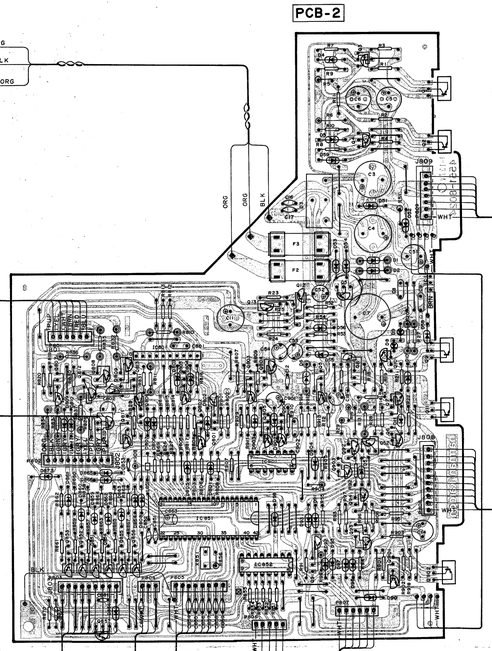
▬ ▬ ▬ . . . . . HX-PRO SIGNAL

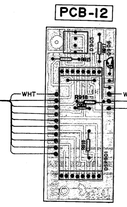
1. ALL RESISTANCES VALUES ARE IN Ω.
   kΩ= 1000Ω,. MΩ= 1000kΩ
2. THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCES VALUES ARE IN μF UNLESS OTHERWISE NOTED. P = μμF
   AND ALL ELECTRICAL CAPACITANCES VOLTAGE VALUES ARE GIVEN WITHOUT UNIT. THE OMITTED UNIT IS V. 47/50 → 47μF/50V
4. V: DC VOLTAGE AT NO SIGNAL
   . . . V STOP MODE
   [. . . V] PLAYBACK MODE
   (. . . V) RECORDING MODE
5. ⚠ SAFETY-REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS. THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.

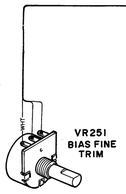
WIRING DIAGRAM

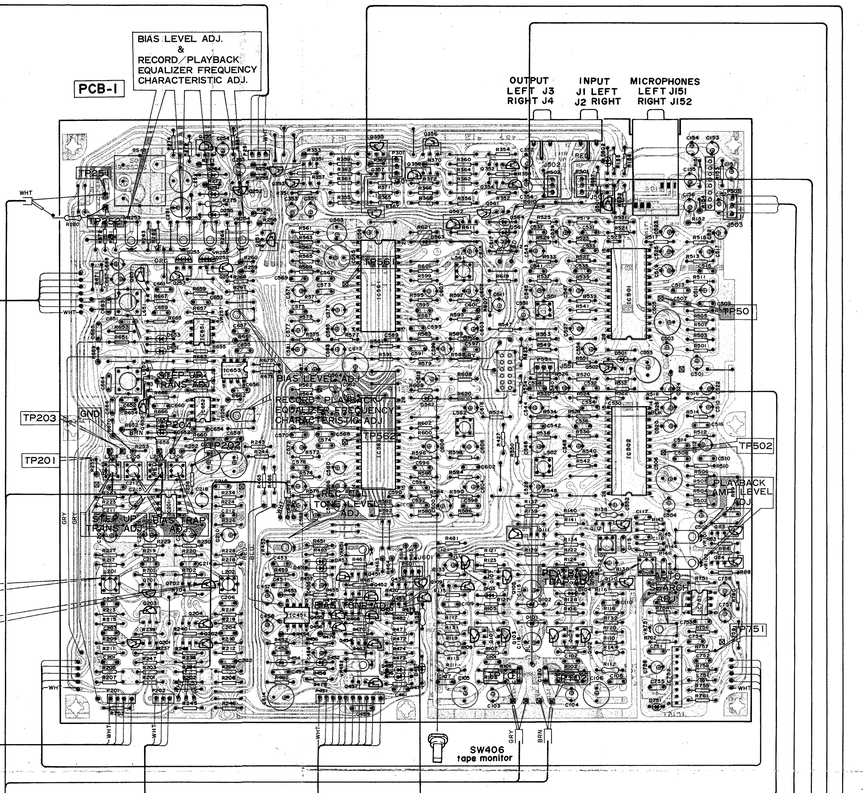


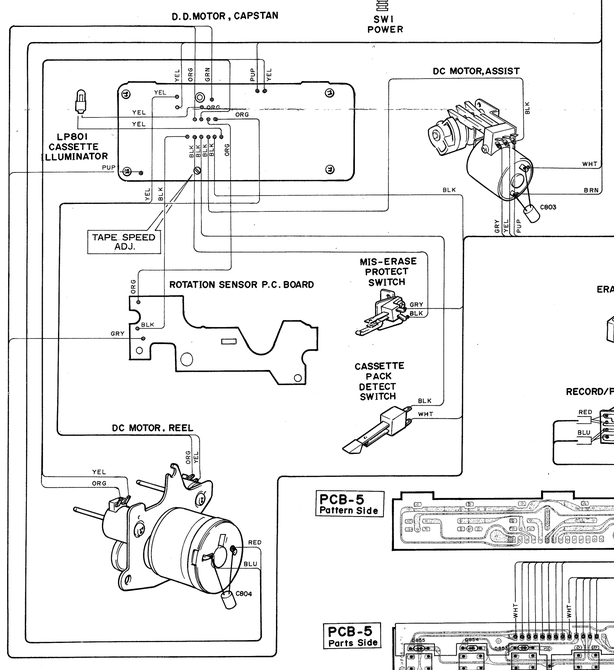


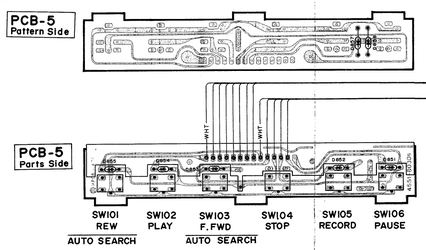


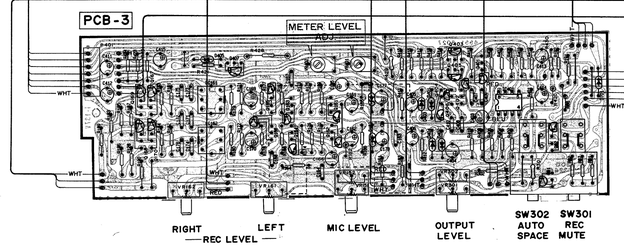


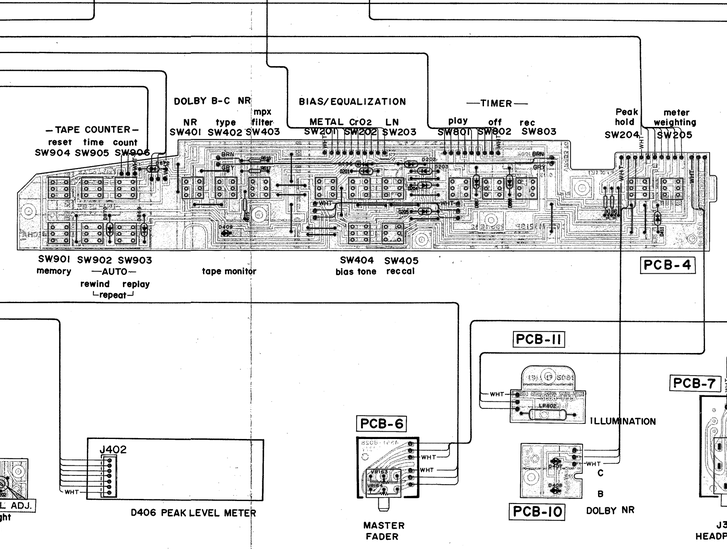




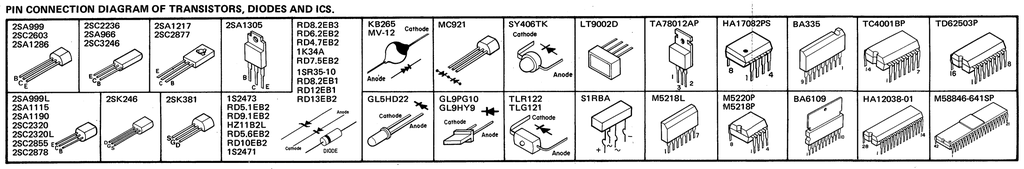






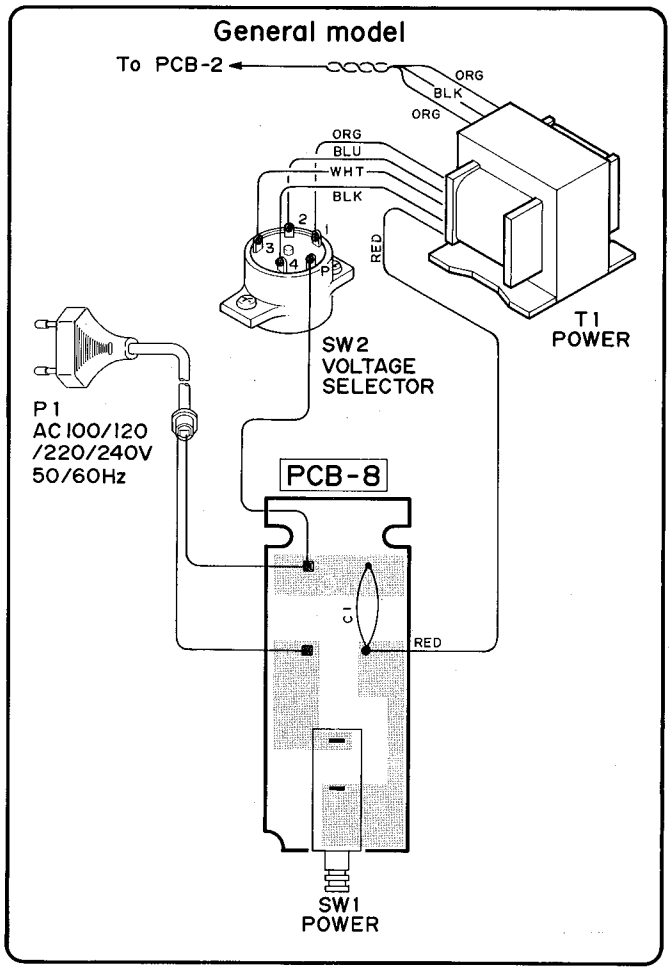


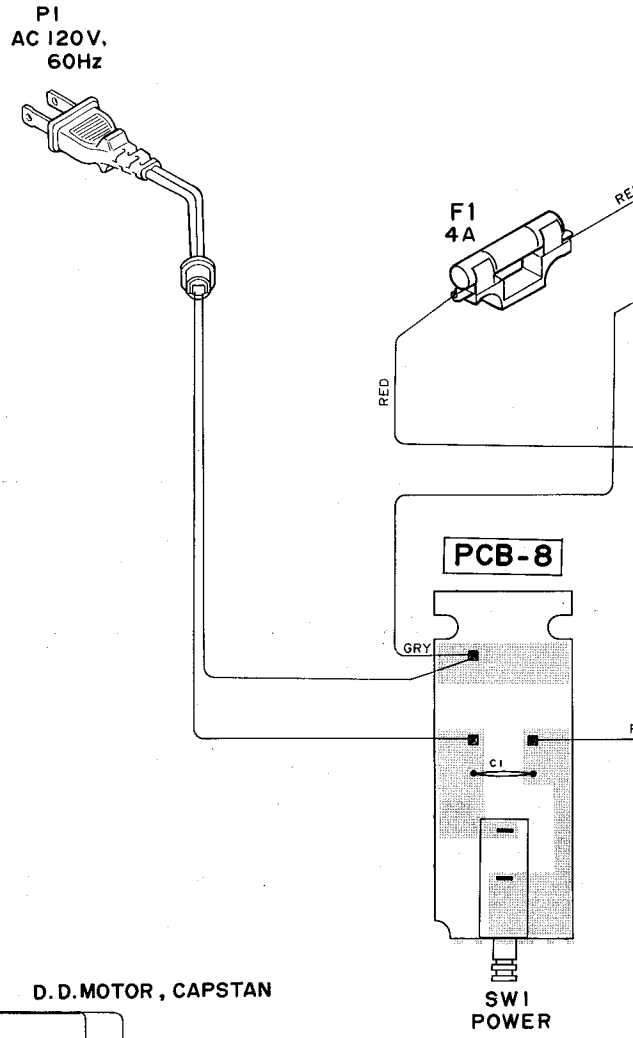
PIN CONNECTION DIAGRAM OF TRANSISTORS, DIODES AND ICS.

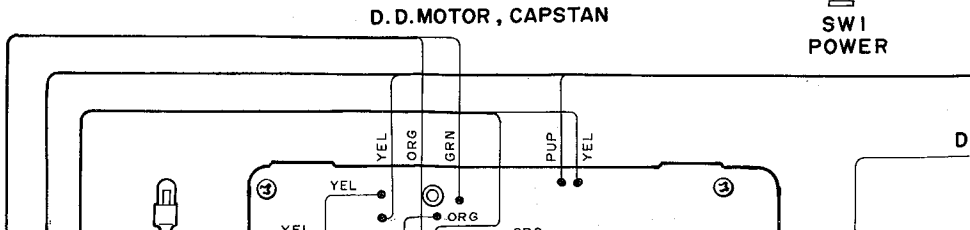


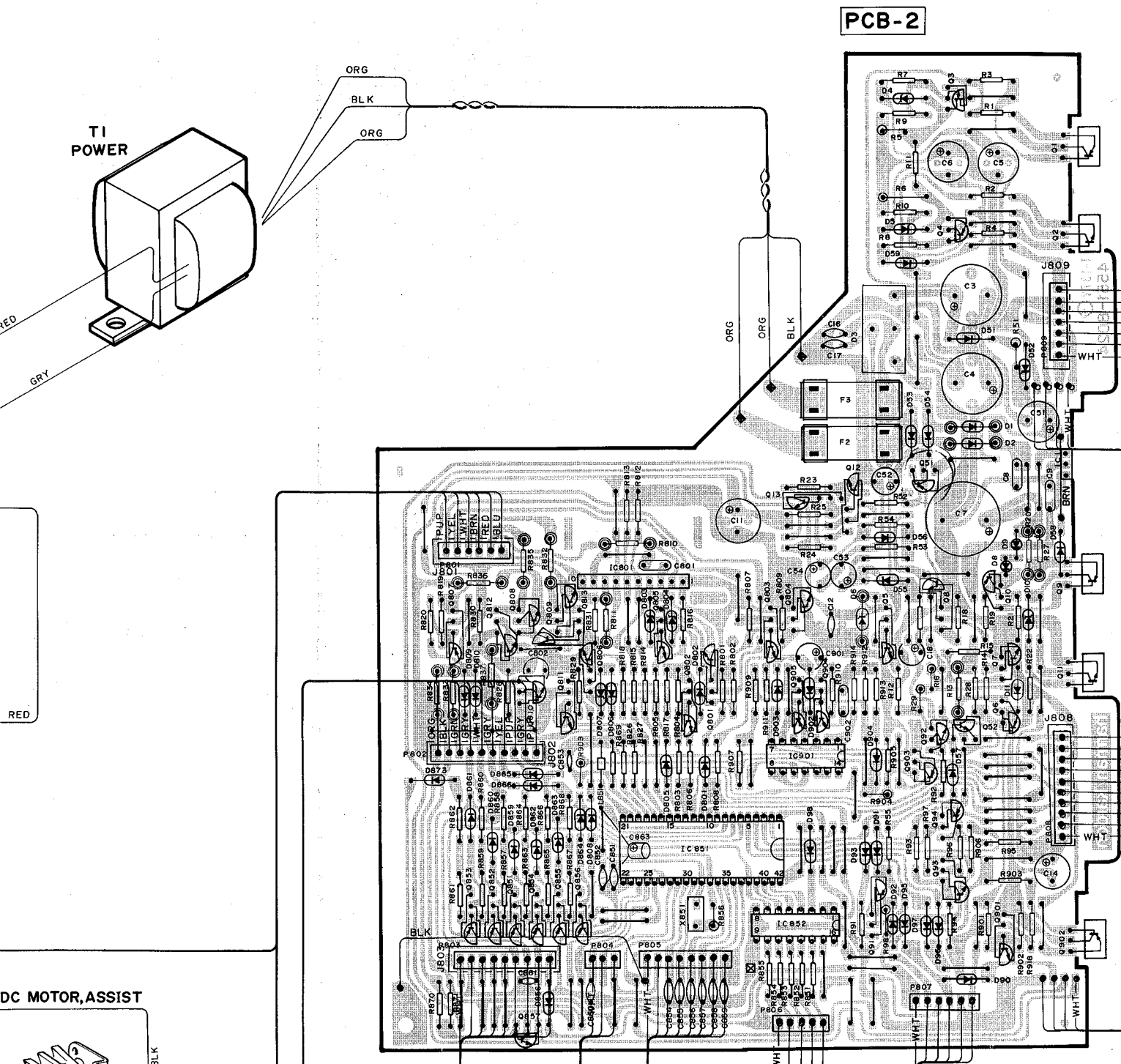
- WIRE COLOR ABBREVIATIONS
  - RED : Red
  - ORG : Orange
  - BLU : Blue
  - WHT : White
  - BLK : Black
  - GRN : Green
  - YEL : Yellow
  - PUP : Purple
  - PIK : Pink

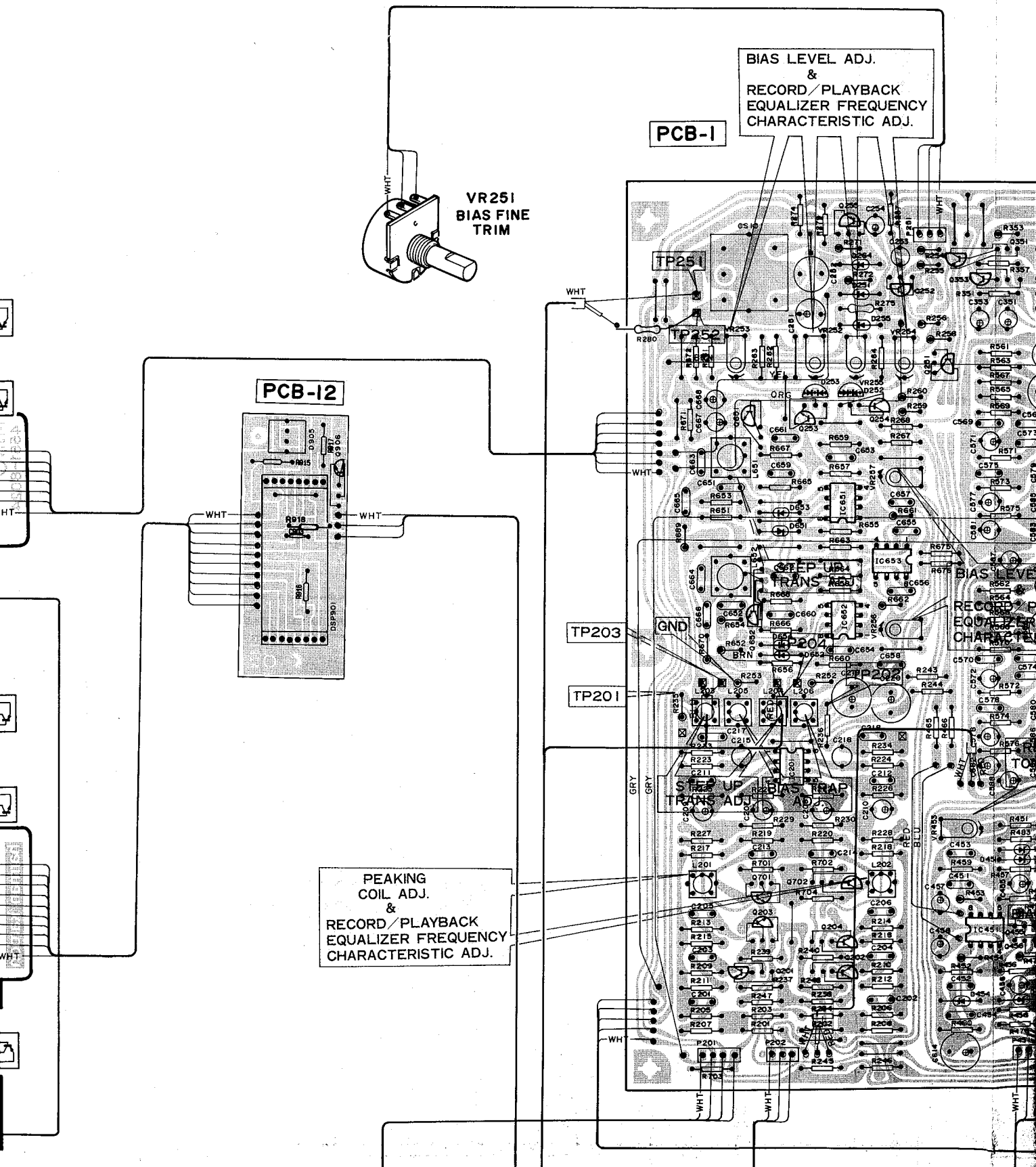
WIRING DIAGRAM



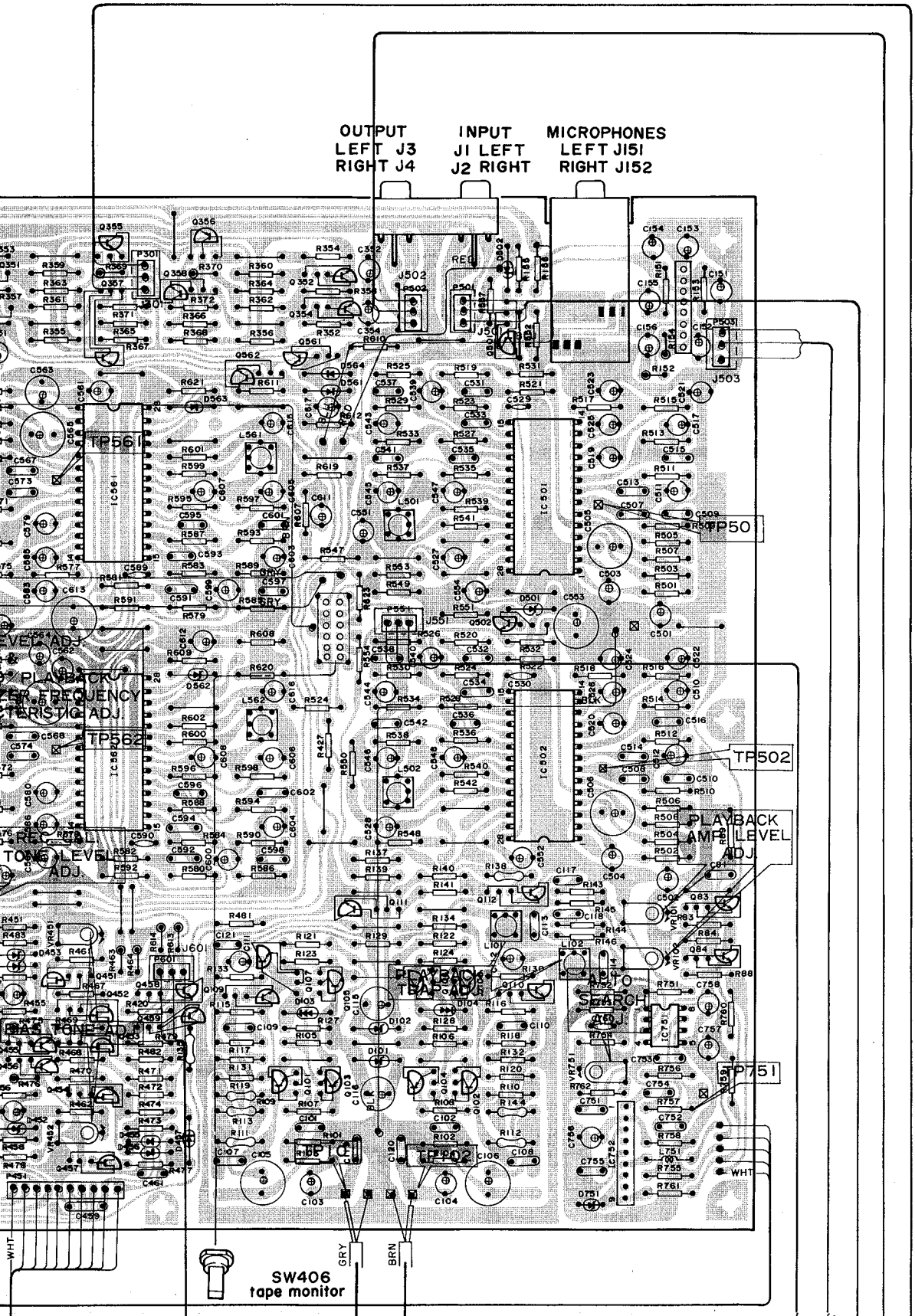


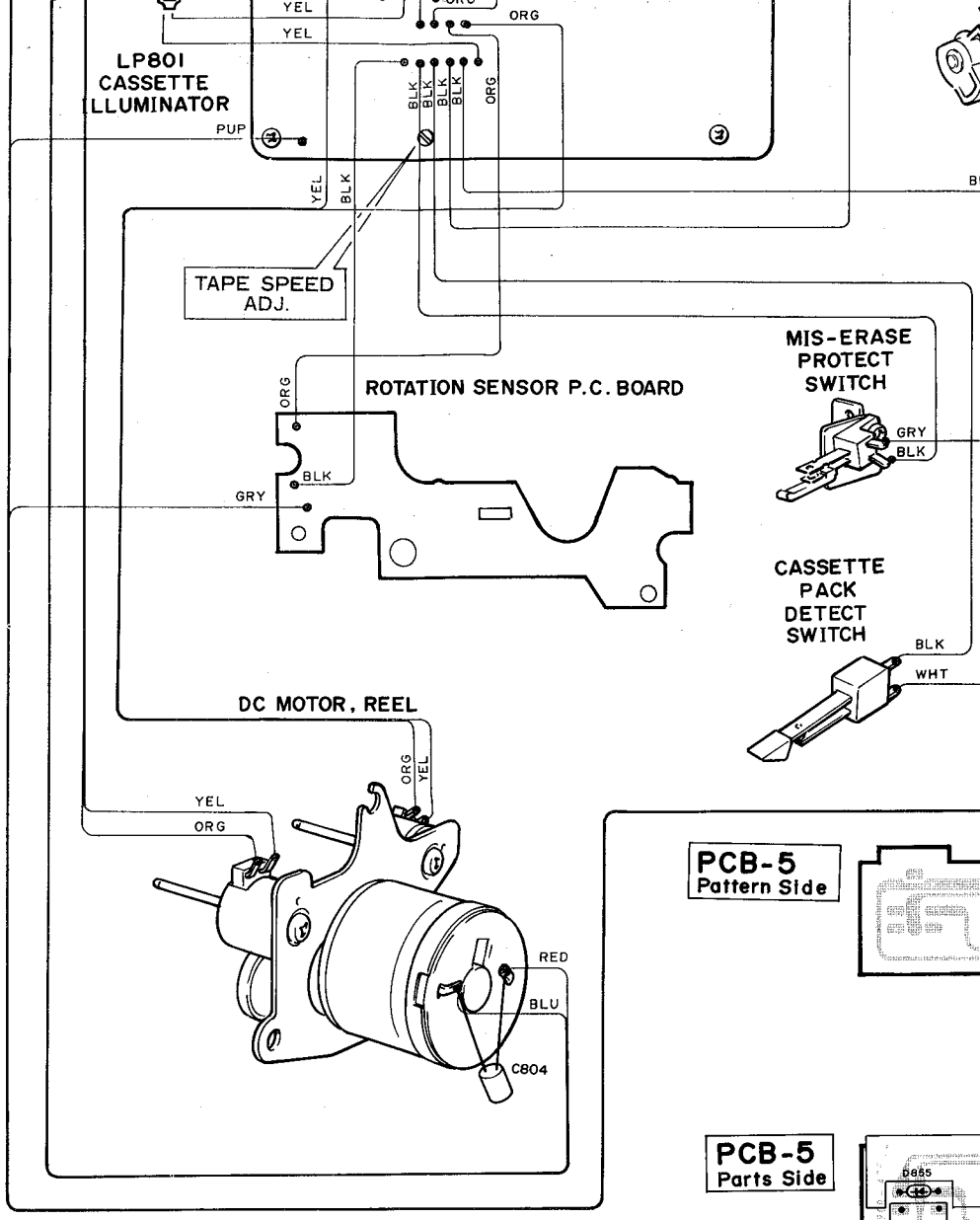



PCB-2
TI POWER
ORG
BLK
ORG
RED
GRY
ORG
ORG
BLK
RED
DC MOTOR, ASSIST
BLK
J809
J808
J802
J803
P804
P805
P807
WHT
BRN
BLK
IC901
IC851
IC852
F3
F2


BIAS LEVEL ADJ.
&
RECORD/PLAYBACK
EQUALIZER FREQUENCY
CHARACTERISTIC ADJ.
PCB-1
VR251
BIAS FINE
TRIM
TP251
TP252
PCB-12
TP203
GND
TP204
TP202
TP201
STEP UP
TRANS ADJ.
BIAS TRAP
ADJ.
PEAKING
COIL ADJ.
&
RECORD/PLAYBACK
EQUALIZER FREQUENCY
CHARACTERISTIC ADJ.
WHT
GRY
RED
BLU
ORG
BRN

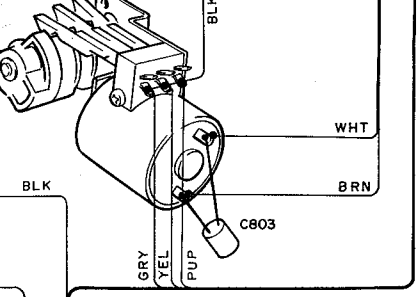
M	N	O	P


OUTPUT
LEFT J3
RIGHT J4
INPUT
J1 LEFT
J2 RIGHT
MICROPHONES
LEFT J151
RIGHT J152
TP50
TP502
TP751
TP562
TP56
PLAYBACK AMP LEVEL ADJ
AUTO SEARCH
SW406
tape monitor
WHT
GRY
BRN

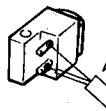


PIN CONNECTION DIAGRAM OF TRANSISTORS, DIODES AND ICS.

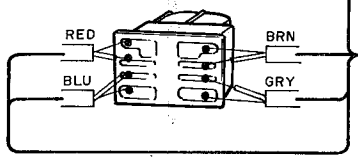
2SA999 2SC2603 2SA1286	2SC2236 2SA966 2SC3246	2SA1217 2SC2877	2SA1305	RD8.2EB3 RD6.2EB2 RD4.7EB2 1K34A RD7.5EB2 1SR35-10 RD8.2EB1 RD12EB1 RD13EB2	KB265 MV-12	MC921	SY406TK
2SA999L 2SA1115 2SA1190 2SC2320 2SC2320L 2SC2855 2SC2878	2SK246	2SK381	1S2473 RD5.1EB2 RD9.1EB2 HZ11B2L RD5.6EB2 RD10EB2 1S2471		GL5HD22	GL9PG10 GL9HY9	TLR122 TLG121

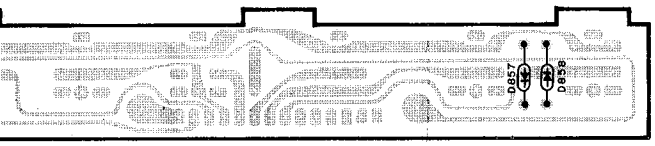


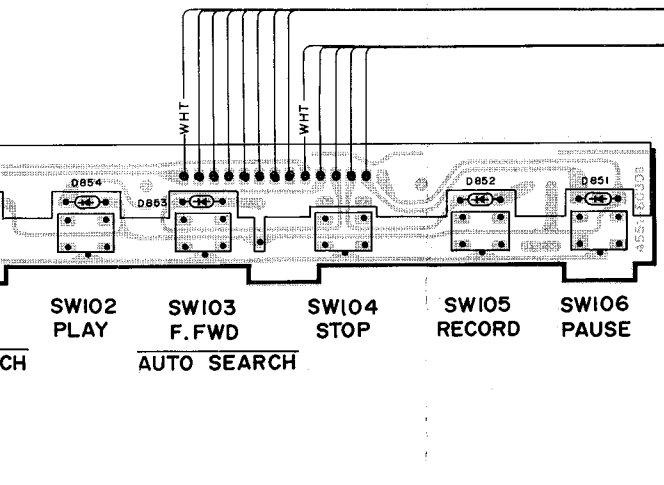
ERASE HEAD



RECORD/PLAYBACK HEAD



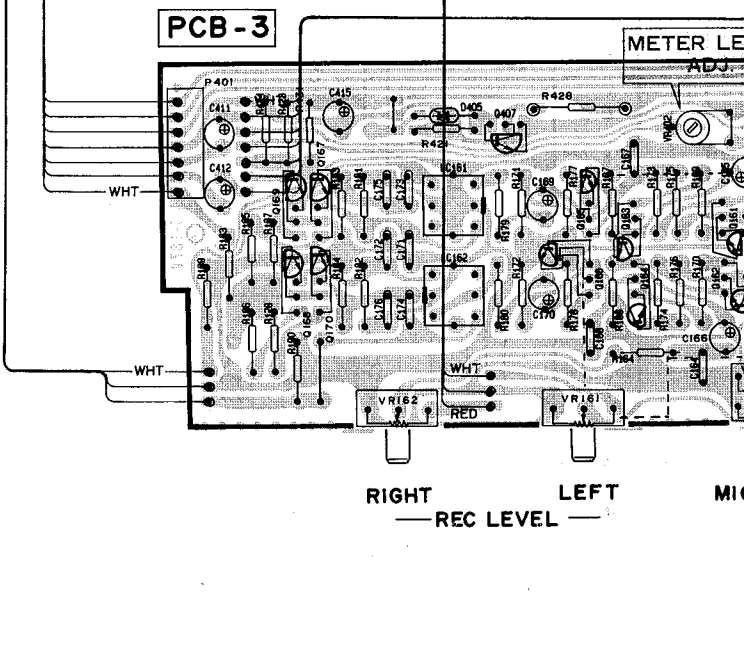




SWI02 PLAY | SWI03 F.FWD | SWI04 STOP | SWI05 RECORD | SWI06 PAUSE

AUTO SEARCH

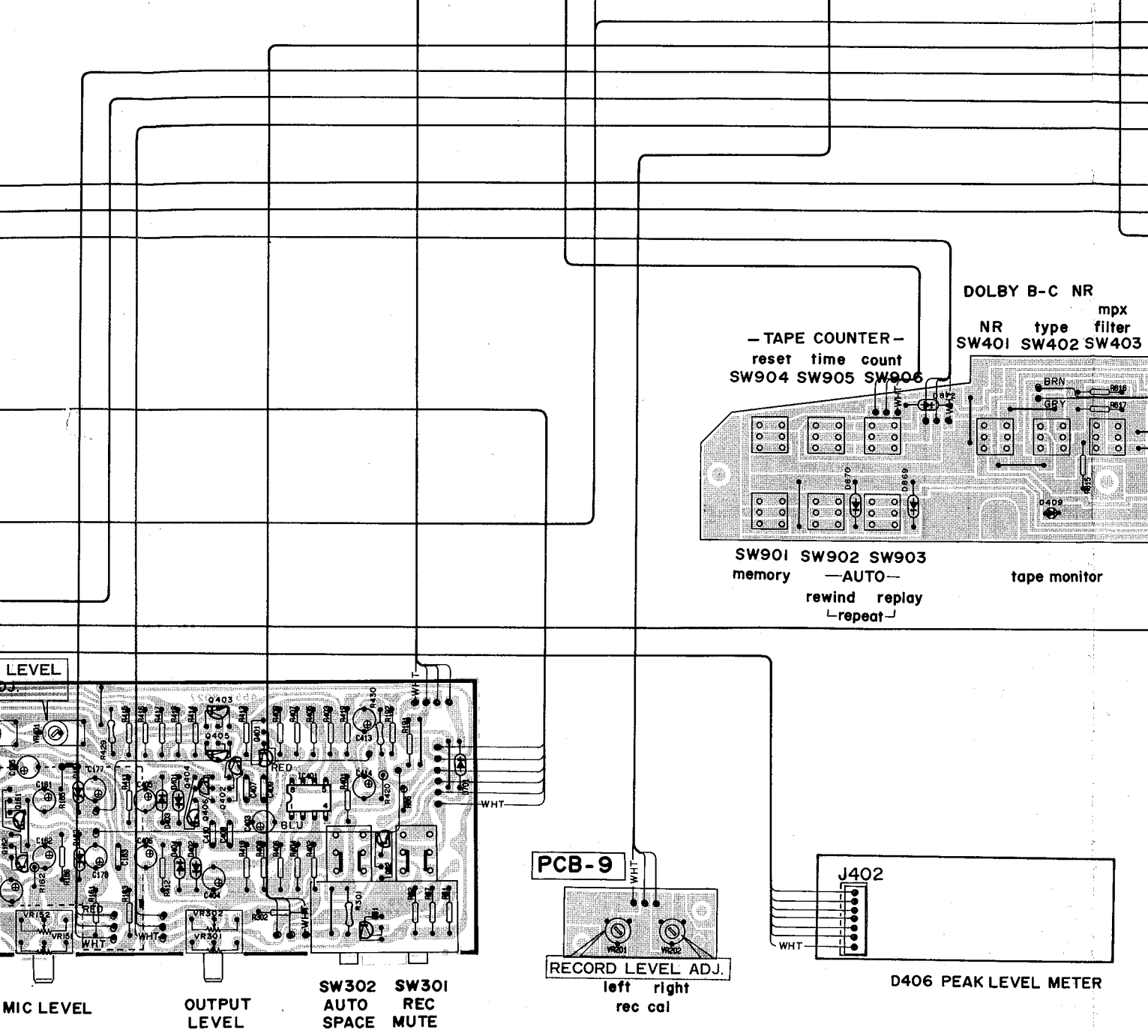
PCB-3

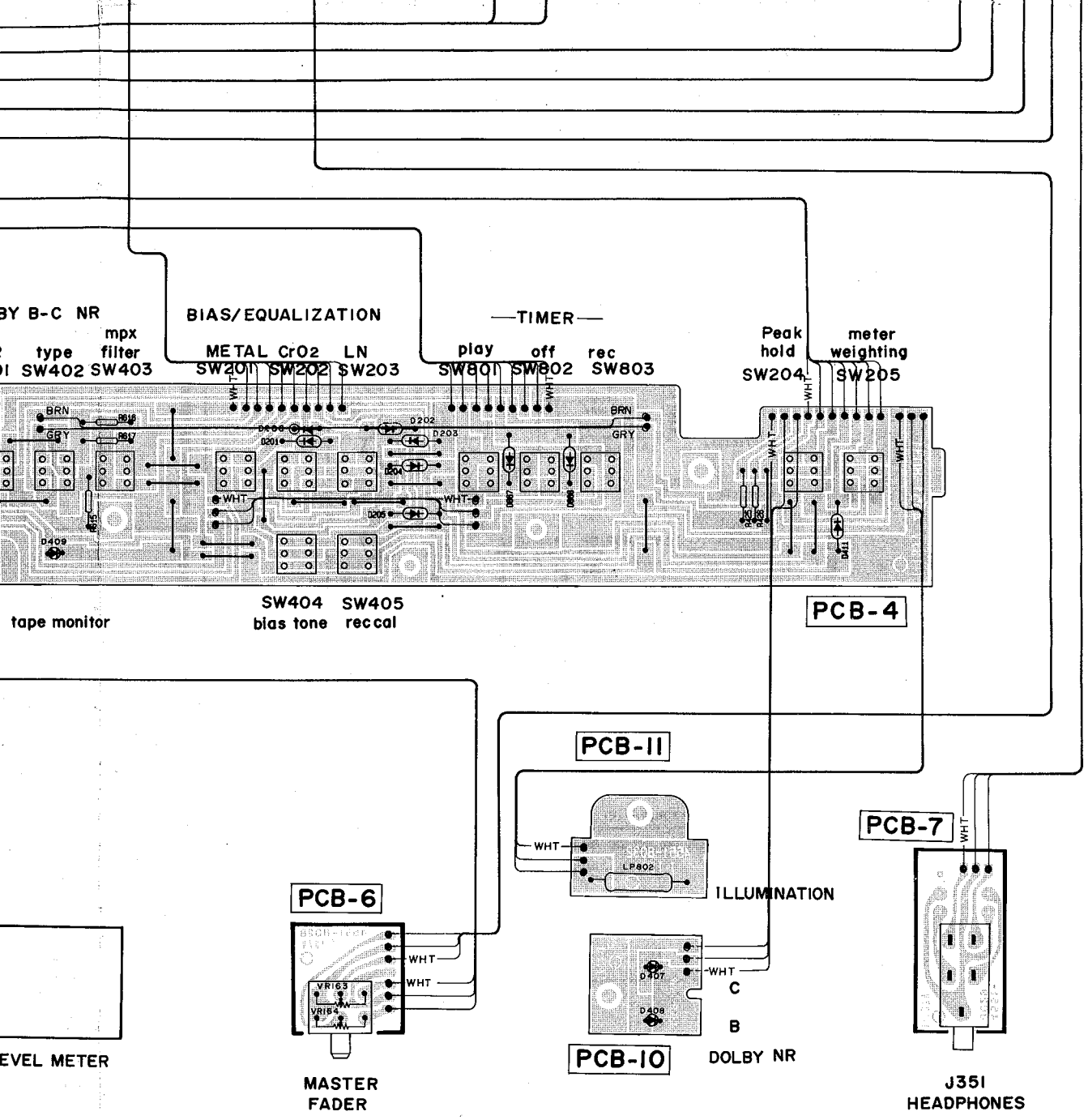


RIGHT LEFT

REC LEVEL

	LT9002D	TA78012AP	HA17082PS	BA335	TC4001BP	TD62503P
	S1RBA	M5218L	M5220P M5218P	BA6109	HA12038-01	M58846-641SP


DOLBY B-C NR
mpx
NR type filter
SW401 SW402 SW403
— TAPE COUNTER —
reset time count
SW904 SW905 SW906
SW901 SW902 SW903
memory —AUTO—
rewind replay
repeat
tape monitor
LEVEL
PCB-9
RECORD LEVEL ADJ.
left right
rec cal
J402
D406 PEAK LEVEL METER
MIC LEVEL
OUTPUT LEVEL
SW302 AUTO SPACE
SW301 REC MUTE



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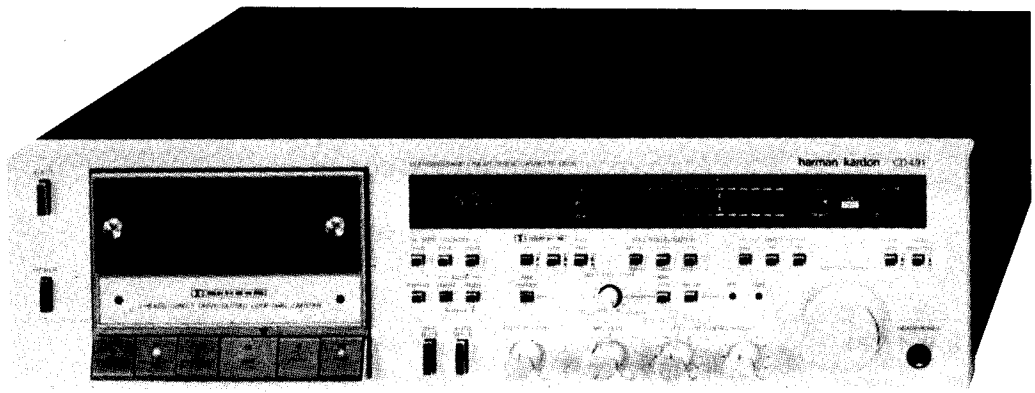
The Harman Kardon Model CD491

Manual 66C

ULTRAWIDEBAND LINEAR PHASE CASSETTE DECK

Technical Manual



SUPPLEMENTARY MANUAL 2

MODIFICATIONS WERE MADE AT SERIAL NUMBER 10601 TO IMPROVE PERFORMANCE. EXCEPT FOR THE CHANGES AS NOTED IN THIS SUPPLEMENT, REFER TO MANUALS 66A AND 66B FOR ALL OTHER PARTS AND SERVICE INFORMATION.

harman/kardon

240 Crossways Park West, Woodbury, N.Y. 11797
1112-H15266C1 P-078503 1650 Printed in Japan

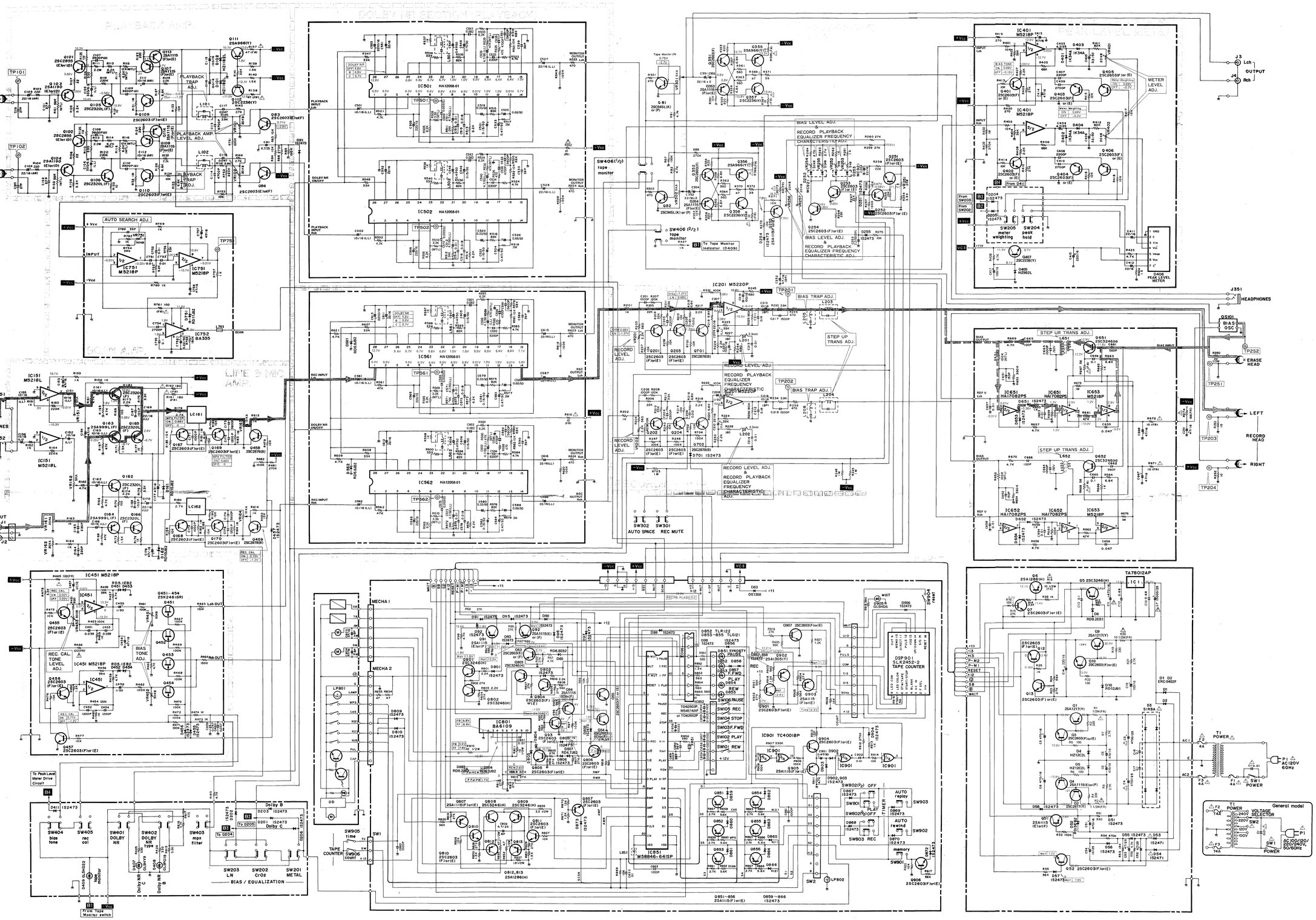
CD491

ELECTRICAL PARTS LIST

Ref. No.	Part No.	Description
	PCB-1 MAIN P.C. BOARD	
	RESISTORS	
R509, 510, 569, 570	5174-332381	3.3kΩ, ±1%, 1/4W, Metal
R529, 530, 589, 590	5174-473381	47kΩ, ±1%, 1/4W, Metal
	CAPACITORS	
C81	5342-475D0951	0.47μF, ±20%, 25V, Electrolytic
C103, 104	5345-226C0951	22μF, ±20%, 16V, Electrolytic
C111, 112	5345-106C0951	10μF, ±20%, 16V, Electrolytic
C505, 506, 565, 566	5345-227C041	220μF, ±20%, 16V, Electrolytic
C509, 510, 569, 570	5359-333741	0.033μF, ±2%, 100V, Polypropylene
C511, 512, 539, 540, 571, 572, 599, 600	5345-L475M50	4.7μF, ±20%, 50V, Electrolytic
C519, 520, 579, 580	5345-L334M50	0.33μF, ±20%, 50V, Electrolytic
C525, 526, 585, 586	5345-L684M50	0.68μF, ±20%, 50V, Electrolytic
	INTEGRATED CIRCUITS	
IC501, 502, 561, 562	5652-12058-01	HA12058-01
	TRANSISTORS	
Q107, 108, 113, 114	5611-1115(F)	2SA1115(F) or 2SA1115(E)
Q458, 459, 701, 702	5613-2878(B)	2SC2878(B)
	PCB-2 LOGIC CONTROL P.C. BOARD	
	RESISTORS	
⚠R1, 2	5102-1R05114	1Ω, ±5%, 1/2W, Fuse
⚠R13, 20	5102-1005114	10Ω, ±5%, 1/2W, Fuse
	CAPACITORS	
C5, 6, 8, 9, 11, 51	5345-477C041	470μF, ±20%, 16V, Electrolytic
C14	5345-227C041	220μF, ±20%, 16V, Electrolytic
C18	5345-107C041	100μF, ±20%, 16V, Electrolytic
C863	5359-1027851	1000pF, ±2%, 100V, Polypropylene
	TRANSISTORS	
Q3, 10, 907	5613-2603(F)	2SC2603(F) or 2SC2603(E)
Q53, 54	5613-2603(E)	2SC2603(E) or 2SC2603(F)
Q92	5611-1115(E)	2SA1115(E) or 2SA1115(F)
	DIODES	
D1, 2	5632-ERC0402F	ERC0402F
D4, 5	5635-HZ12C2L	Zener, HZ12C2L
D60	5635-RD6R8EB2	Zener, RD6.8EB2
D63	5632-DS135E	DS135E
D99	5631-1S2473	1S2473
	COIL	
L851	5995-3R9233	
	MISCELLANEOUS	
P803	4443-090185	Connector, 9 Pos.
	PCB-3 VR P.C. BOARD	
	CAPACITOR	
C417	5345-107C041	100μF, ±20%, 16V, Electrolytic
	DIODE	
D405	5635-HZ9B2L	Zener, HZ9B2L
	PCB-12 TAPE COUNTER P.C. BOARD	
D905	5637-GL5HD5	L.E.D., GL5HD5, Red, Wait
D906	5631-1S2473	Diode, 1S2473

 ⚠ SAFETY RELATED COMPONENT. USE ONLY EXACT REPLACEMENT PART AS SPECIFIED.

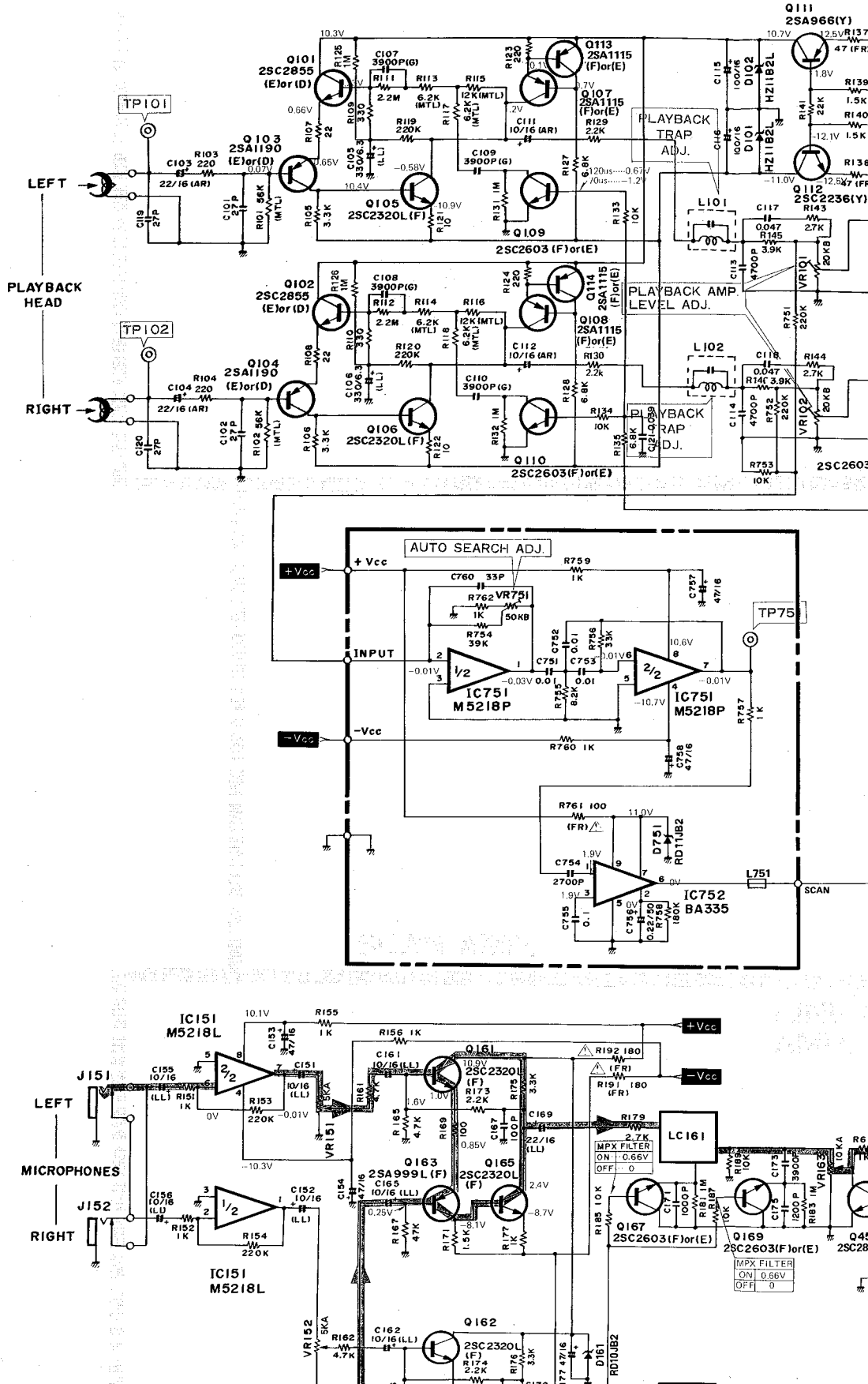
SCHEMATIC DIAGRAM

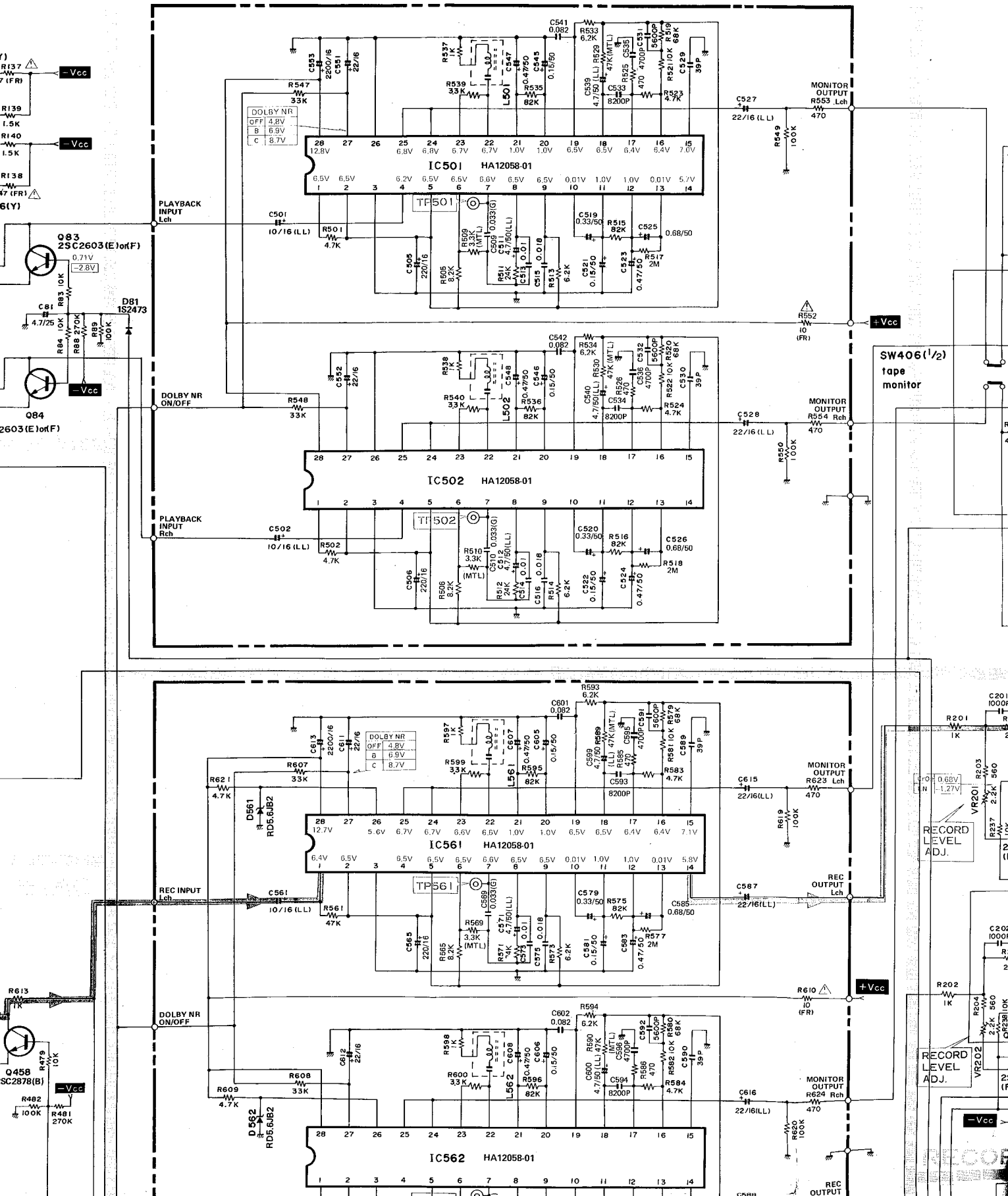


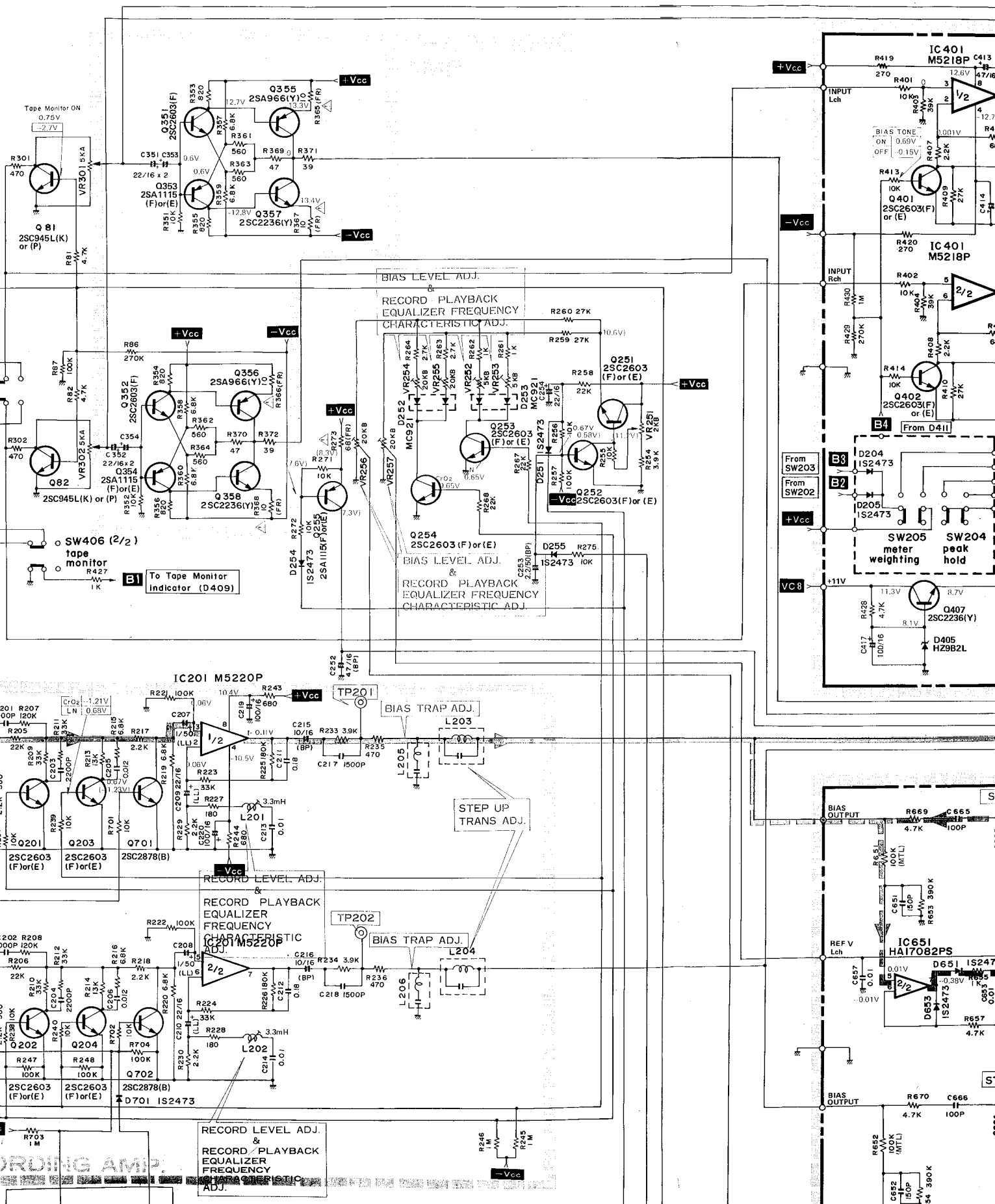
RECORDING SIGNAL (Lch) . . . . .
PLAYBACK SIGNAL (Rch) . . . . .
HX-PRO SIGNAL . . . . .

1. ALL RESISTANCES VALUES ARE IN Ω.
   kΩ= 1000Ω, MΩ= 1000kΩ
2. THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCES VALUES ARE IN μF UNLESS OTHERWISE NOTED. P = μμF
   AND ALL ELECTRICAL CAPACITANCES VOLTAGE VALUES ARE GIVEN WITHOUT UNIT. THE OMITTED UNIT IS V, 47/50→ 47μF/50V
4. V : DC VOLTAGE AT NO SIGNAL
   . . . V STOP MODE
   . . . V PLAYBACK MODE
   (. . . V) RECORDING MODE
5. ⚠ SAFETY-REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS. THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.

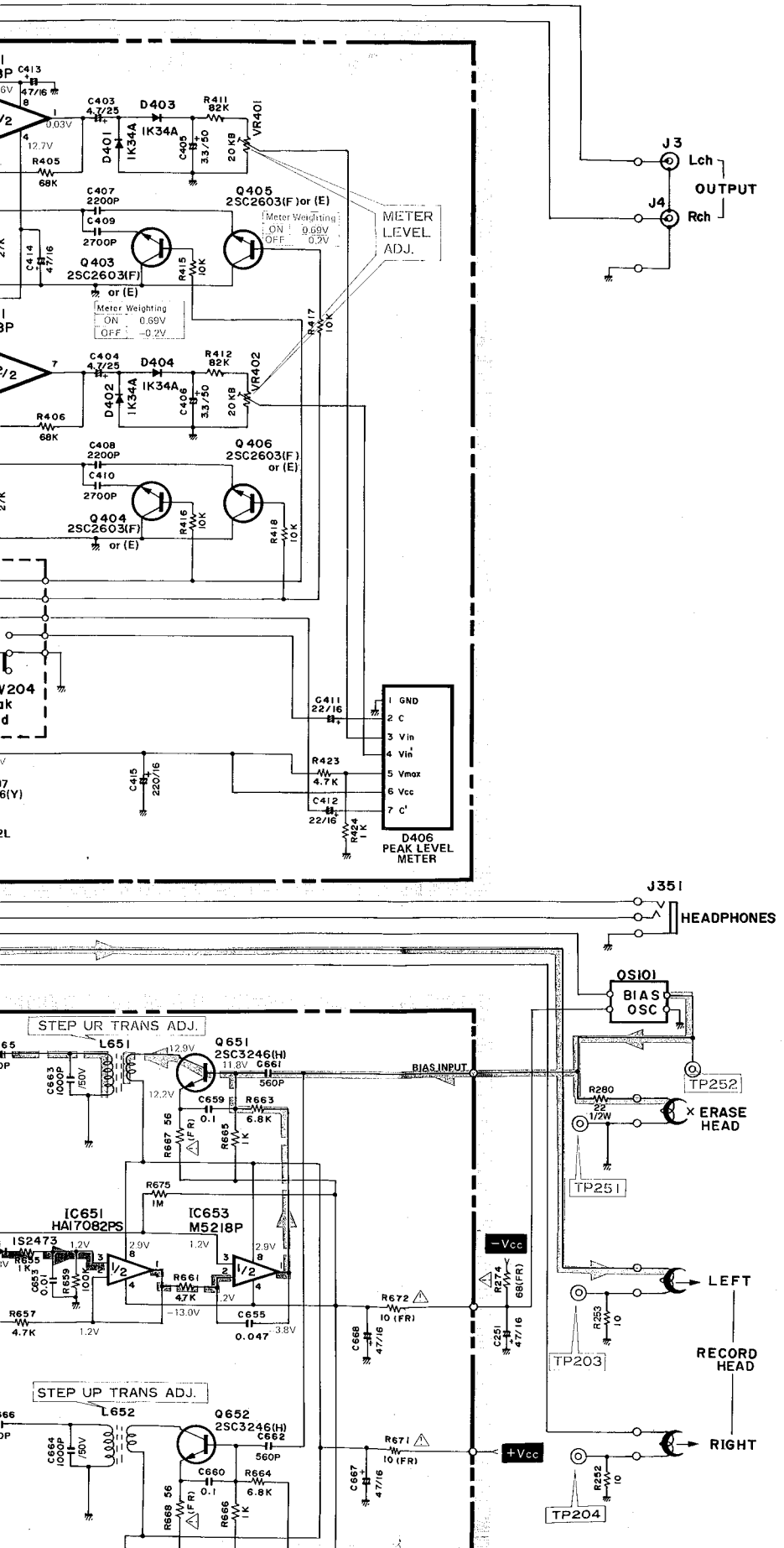
SCHEMATIC DIAGRAM

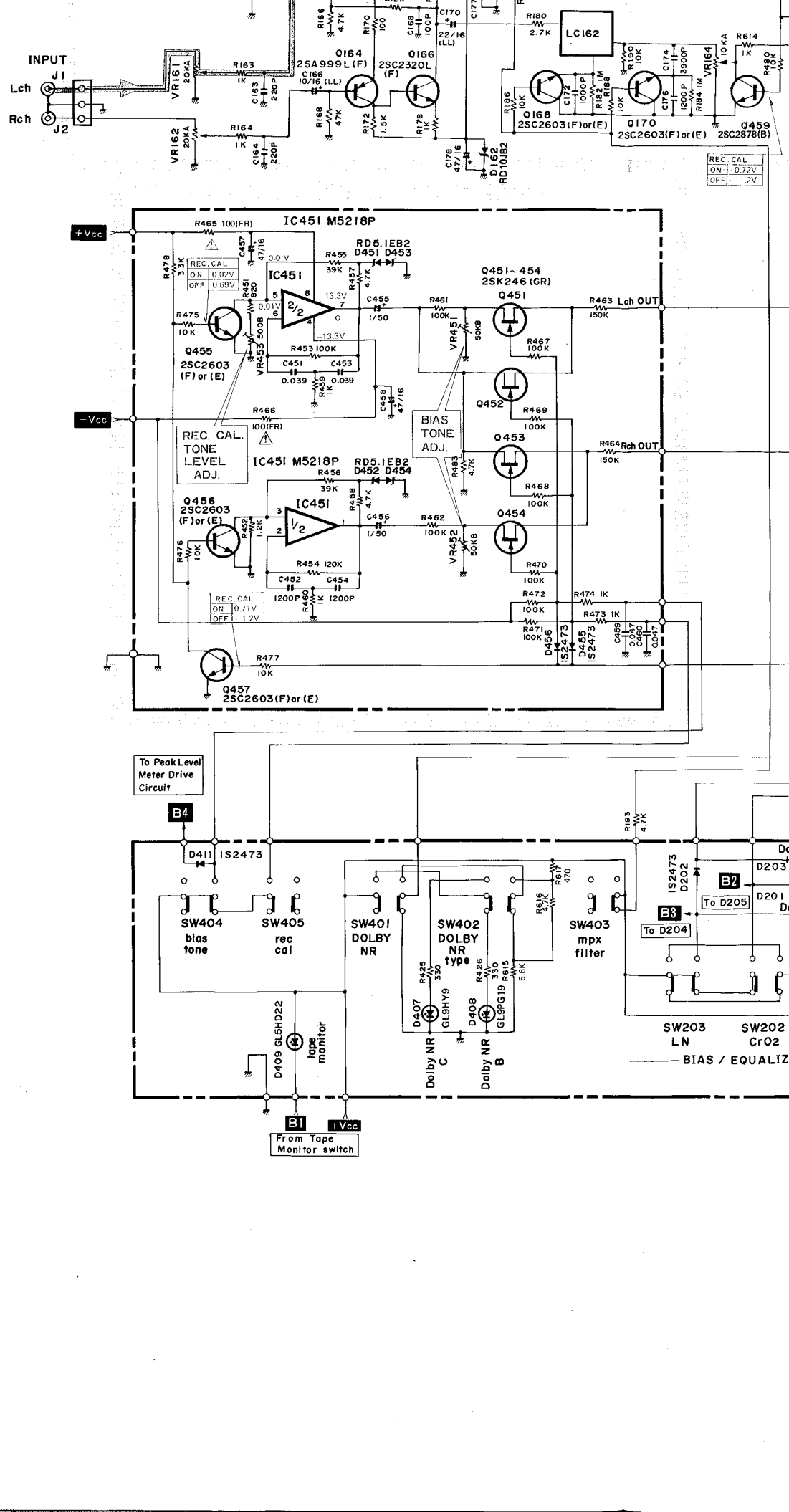


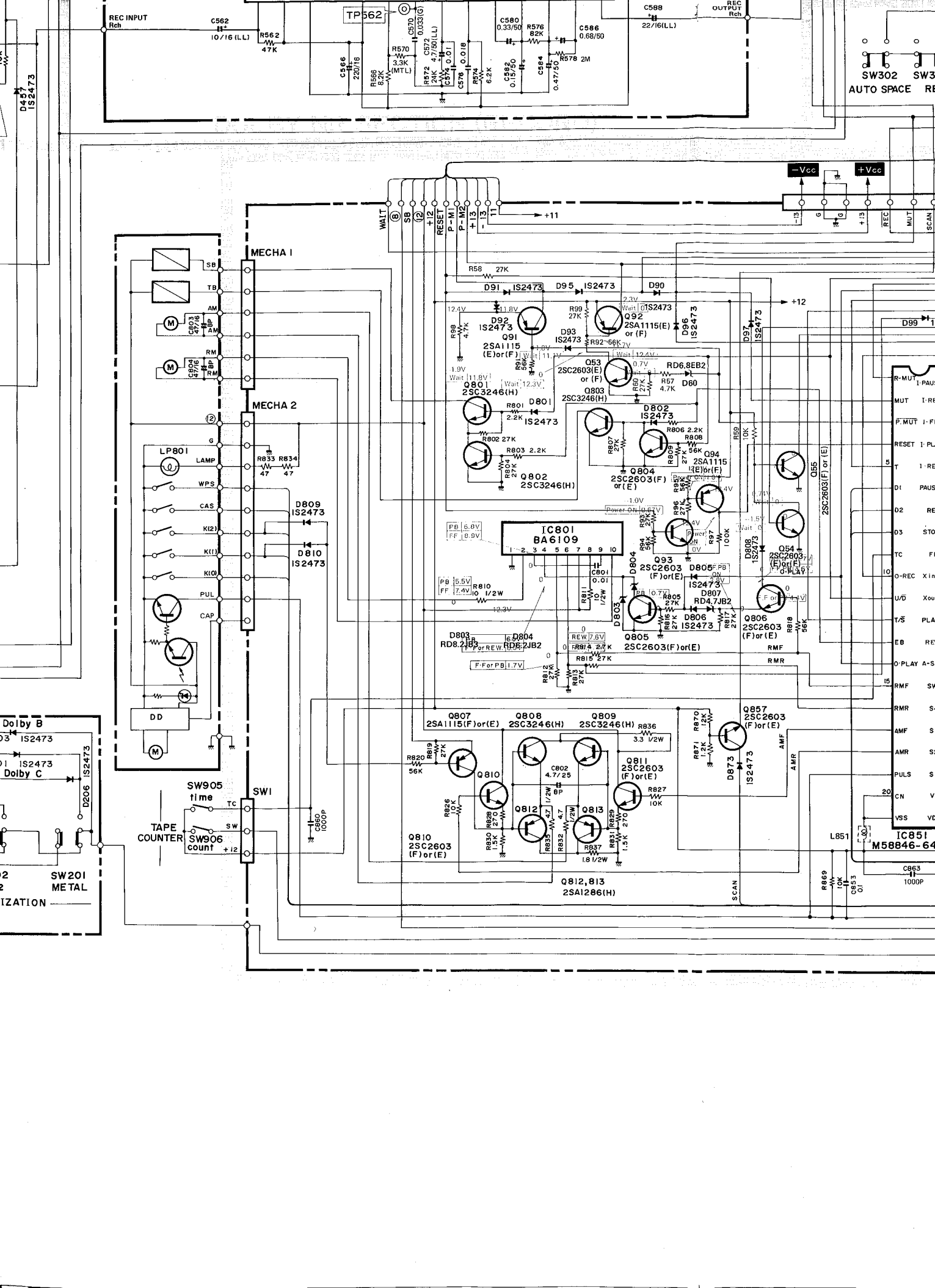

IC501 HA12058-01
IC502 HA12058-01
IC561 HA12058-01
IC562 HA12058-01
PLAYBACK INPUT Lch
PLAYBACK INPUT Rch
REC INPUT Lch
DOLBY NR ON/OFF
MONITOR OUTPUT R553 Lch
MONITOR OUTPUT R554 Rch
MONITOR OUTPUT R623 Lch
MONITOR OUTPUT R624 Rch
REC OUTPUT Lch
REC OUTPUT
SW406(1/2) tape monitor
RECORD LEVEL ADJ.
RECORD LEVEL ADJ.
+Vcc
-Vcc
Q83 2SC2603(E)or(F)
Q84
Q458 2SC2878(B)
D81 1S2473
D561 RD5.6JB2
D562 RD5.6JB2

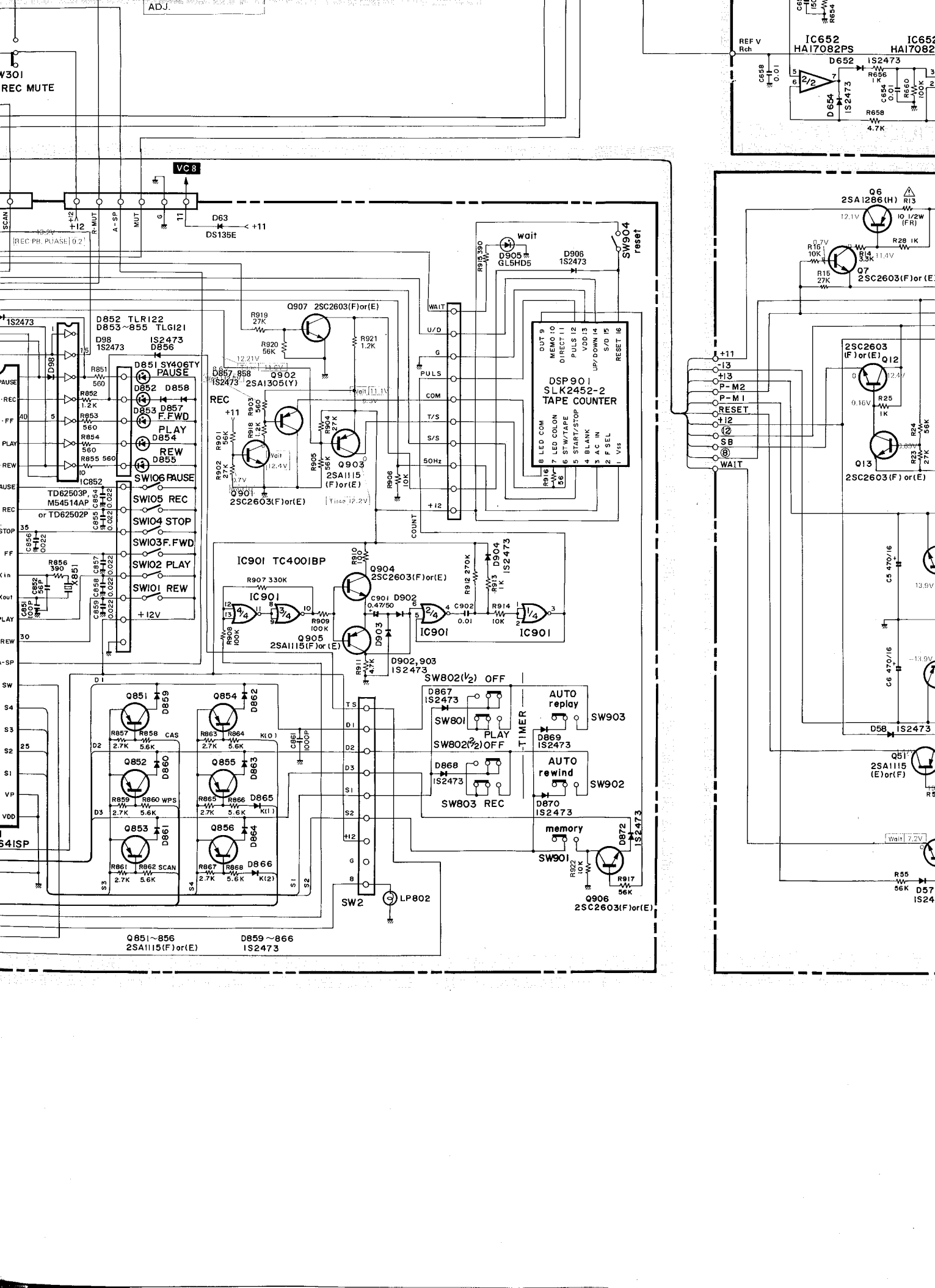

Tape Monitor ON
0.75V
-2.7V
Q 81
2SC945L(K)
or (P)
VR301 5KA
Q351
2SC2603(F)
Q353
2SA1115
(F)or(E)
Q355
2SA966(Y)
Q357
2SC2236(Y)
+Vcc
-Vcc
Q352
2SC2603(F)
Q354
2SA1115
(F)or(E)
Q356
2SA966(Y)
Q358
2SC2236(Y)
Q82
2SC945L(K) or (P)
VR302 5KA
SW406 (2/2)
tape
monitor
B1
To Tape Monitor
Indicator (D409)
BIAS LEVEL ADJ.
&
RECORD PLAYBACK
EQUALIZER FREQUENCY
CHARACTERISTIC ADJ.
Q251
2SC2603
(F)or(E)
Q252
2SC2603(F)or(E)
Q253
2SC2603
(F)or(E)
Q254
2SC2603(F)or(E)
D252
MC921
D253
MC921
D254
1S2473
D255
1S2473
D251
1S2473
Q255
2SA1115(F)or(E)
IC401
M5218P
INPUT
Lch
INPUT
Rch
BIAS TONE
ON 0.69V
OFF -0.15V
Q401
2SC2603(F)
or (E)
Q402
2SC2603(F)
or (E)
B4
From D411
From SW203
From SW202
B3
B2
D204
1S2473
D205
1S2473
SW205
meter
weighting
SW204
peak
hold
VC8
+11V
Q407
2SC2236(Y)
D405
HZ9B2L
IC201 M5220P
TP201
TP202
BIAS TRAP ADJ.
L203
L204
L205
L206
STEP UP
TRANS ADJ.
L201
L202
3.3mH
Q201
Q203
Q701
Q202
Q204
Q702
2SC2603
(F)or(E)
2SC2878(B)
D701 1S2473
RECORD LEVEL ADJ.
&
RECORD PLAYBACK
EQUALIZER
FREQUENCY
CHARACTERISTIC
ADJ.
IC651
HA17082PS
REF V
Lch
BIAS
OUTPUT
D651 1S2473
D653 1S2473
RECORDING AMP.

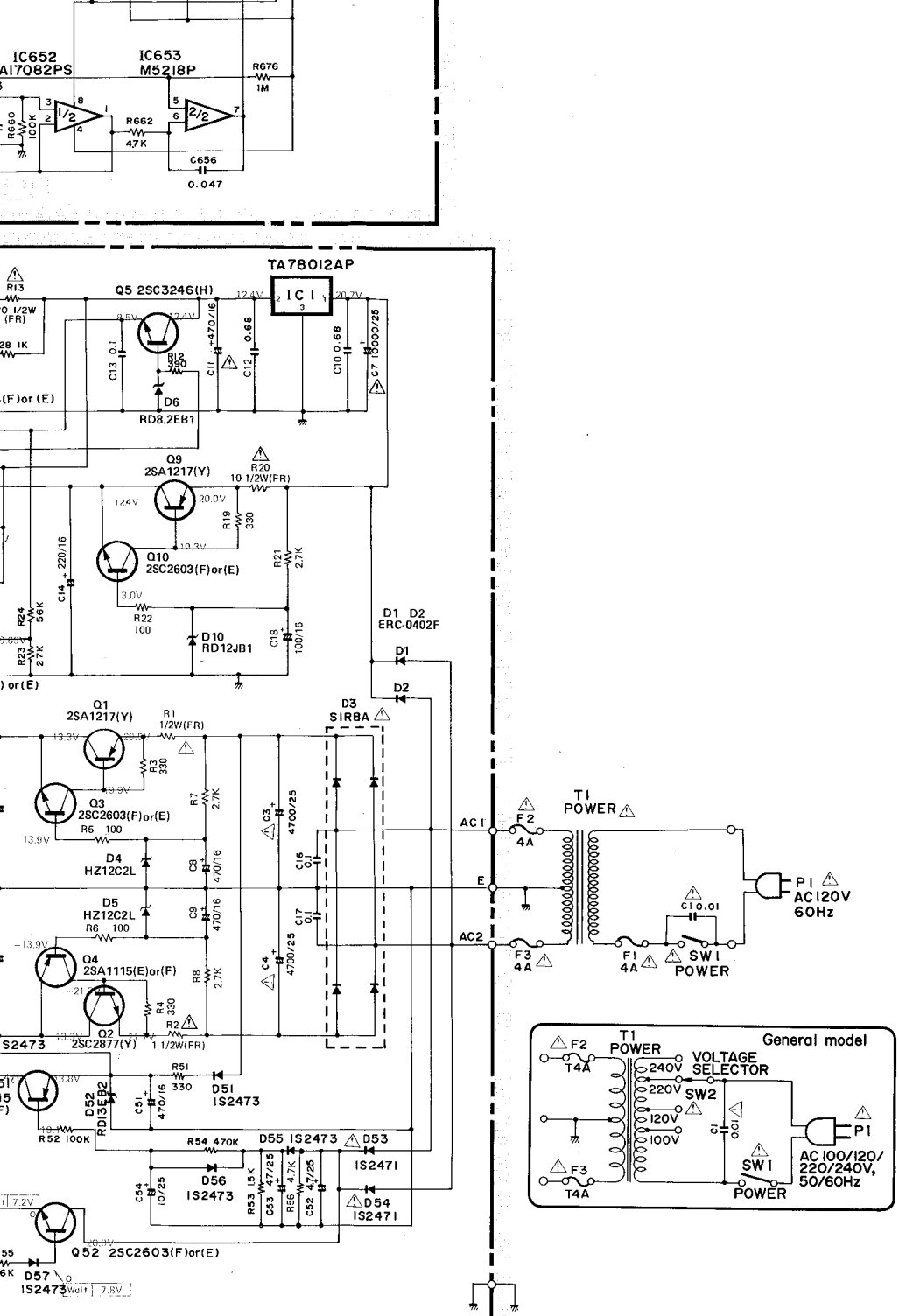
M	N	O	P


J3
Lch
OUTPUT
J4
Rch
METER LEVEL ADJ.
Q405 2SC2603(F) or (E)
Meter Weighting ON 0.69V OFF 0.2V
Q403 2SC2603(F) or (E)
Meter Weighting ON 0.69V OFF -0.2V
Q406 2SC2603(F) or (E)
Q404 2SC2603(F) or (E)
D403 IK34A
D404 IK34A
D401 IK34A
D402 IK34A
D406 PEAK LEVEL METER
1 GND
2 C
3 Vin
4 Vin'
5 Vmax
6 Vcc
7 C'
J351
HEADPHONES
OSI01
BIAS OSC
STEP UR TRANS ADJ.
L651
Q651 2SC3246(H)
BIAS INPUT
TP252
ERASE HEAD
TP251
IC651 HA17082PS
IC653 M5218P
-Vcc
LEFT
RECORD HEAD
TP203
RIGHT
+Vcc
TP204
STEP UP TRANS ADJ.
L652
Q652 2SC3246(H)


INPUT
J1
Lch
Rch
J2
VR161 20KA
VR162 20KA
R163 1K
R164 1K
C163 220P
C164 220P
C166 10/16 (LL)
Q164 2SA999L (F)
Q166 2SC2320L (F)
R166 4.7K
R168 47K
R170 100
R172 1.5K
R178 1K
C168 100P
C170 22/16 (LL)
C178 47/16
D162 RD10JB2
R180 2.7K
LC162
Q168 2SC2603(F)or(E)
Q170 2SC2603(F)or(E)
Q459 2SC2878(B)
R186 10K
C172 1000P
R182 1M
R188 10K
R190 10K
C174 3900P
C176 1200P
R184 1M
VR164 10KA
R614 1K
R480 10K
REC. CAL
ON 0.72V
OFF 1.2V
+Vcc
-Vcc
IC451 M5218P
R465 100(FR)
C457 47/16
R478 3.3K
REC. CAL
ON 0.02V
OFF 0.69V
R451 820
R475 10K
Q455 2SC2603 (F) or (E)
VR453 500B
R453 100K
C451 0.039
C453 0.039
R455 1K
C458 47/16
R466 100(FR)
REC. CAL. TONE LEVEL ADJ.
IC451
2/2
0.01V
13.3V
-13.3V
R455 39K
R457 4.7K
RD5.1EB2 D451 D453
C455 1/50
R461 100K
Q451~454 2SK246 (GR)
Q451
R463 Lch OUT 150K
VR451 50KB
R467 100K
Q452
R469 100K
BIAS TONE ADJ.
Q453
R464 Rch OUT 150K
R483 4.7K
R468 100K
IC451 M5218P
RD5.1EB2 D452 D454
R456 39K
R458 4.7K
Q456 2SC2603 (F)or(E)
R452 1.2K
C456 1/50
R462 100K
Q454
VR452 50KB
R476 10K
R454 120K
C452 1200P
C454 1200P
R460 1K
R470 100K
REC.CAL
ON 0.71V
OFF 1.2V
R472 100K
R474 1K
R473 1K
R471 100K
D456 IS2473
D455 IS2473
C459 0.047
C460 0.047
C461 0.047
R477 10K
Q457 2SC2603(F)or(E)
To Peak Level Meter Drive Circuit
B4
D411 IS2473
R193 4.7K
SW404 bias tone
SW405 rec cal
SW401 DOLBY NR
SW402 DOLBY NR type
SW403 mpx filter
R617 470
R616 4.7K
R425 330
R426 330
R615 5.6K
D407 GL9HY9
D408 GL9PG19
Dolby NR C
Dolby NR B
D409 GL5HD22
tape monitor
B1
+Vcc
From Tape Monitor switch
IS2473 D202
B2
To D205
B3
To D204
D203
D201
SW203 LN
SW202 CrO2
BIAS / EQUALIZ


REC INPUT Rch
C562 10/16(LL)
R562 47K
TP562
C570 0.033(G)
R570 3.3K (MTL)
C572 4.7/50(LL)
C574 0.01
C578 0.018
R574 6.2K
R572 24K
R566 8.2K
C566 220/16
C580 0.33/50
R576 82K
C582 0.15/50
C584 0.47/50
C586 0.68/50
R578 2M
C588 22/16(LL)
REC OUTPUT Rch
SW302 AUTO SPACE
SW303
-Vcc
+Vcc
WAIT
SB
+12
RESET
P-M1
P-M2
+13
-13
+11
MECHA 1
MECHA 2
SB
TB
AM
RM
LP801
LAMP
WPS
CAS
K(2)
K(1)
K(0)
PUL
CAP
DD
R833 47
R834 47
D809 IS2473
D810 IS2473
SW905 time
SW906 count
TC
SW
+12
SW1
TAPE COUNTER
C860 1000P
Dolby B
Dolby C
D206 IS2473
SW201 METAL
IZATION
R58 27K
D91 IS2473
D95 IS2473
D90
D92 IS2473
Q91 2SA1115 (E)or(F)
D93 IS2473
R99 27K
Q92 2SA1115(E) or (F)
D96 IS2473
D97 IS2473
R98 4.7K
R92 56K
R91 56K
Q53 2SC2603(E) or (F)
RD6.8EB2
D60
R60 27K
R57 4.7K
Q801 2SC3246(H)
Q803 2SC3246(H)
D801 IS2473
R801 2.2K
R802 27K
R803 2.2K
R804 27K
Q802 2SC3246(H)
D802 IS2473
R806 2.2K
R807 27K
R809 27K
R808 56K
Q804 2SC2603(F) or(E)
Q94 2SA1115 (E)or(F)
R59 10K
Q55 2SC2603(F) or (E)
Q54 2SC2603 (E)or(E)
D808 IS2473
IC801 BA6109
C801 0.01
R810 10 1/2W
R811 10 1/2W
D804
Q93 2SC2603 (F)or(E)
D805 IS2473
D807 RD4.7JB2
D806 IS2473
Q806 2SC2603 (F)or(E)
R818 56K
D803 RD8.2JB3
D804 RD6.2JB2
Q805 2SC2603(F)or(E)
R814 27K
R815 27K
R812 27K
R813 27K
Q807 2SA1115(F)or(E)
Q808 2SC3246(H)
Q809 2SC3246(H)
R836 3.3 1/2W
R819 27K
R820 56K
Q810
C802 4.7/25
Q811 2SC2603 (F)or(E)
R827 10K
R826 1.2K
R828 220
R830 1K
R835 47
R832 4.7 1/2W
Q812
Q813
R829 270
R831 1.5K
R837 1.8 1/2W
Q810 2SC2603 (F)or(E)
Q812,813 2SA1286(H)
R870 1.2K
R871 1.2K
Q857 2SC2603 (F)or(E)
D873 IS2473
AMF
AMR
SCAN
L851
IC851 M58846-64
C863 1000P
R869 10K
C853 01
R-MUT
MUT
P.MUT
RESET
T
D1
D2
D3
TC
O-REC
U/D
T/S
EB
O-PLAY
RMF
RMR
AMF
AMR
PULS
CN
VSS
REC
MUT
SCAN
+12
+11
D99


ADJ.
REC MUTE
IC652
HA17082PS
REF V
Rch
D652
1S2473
D654
1S2473
R658
4.7K
VC 8
SCAN
+12
R-MUT
A-SP
MUT
G
11
D63
DS135E
+11
REC PB. PUASE
wait
D905
GL5HD5
D906
1S2473
SW904
reset
R915 390
WAIT
U/D
G
PULS
COM
T/S
S/S
50Hz
+12
COUNT
DSP901
SLK2452-2
TAPE COUNTER
OUT 9
MEMO 10
DIRECT 11
PULS 12
VDD 13
UP/DOWN 14
S/D 15
RESET 16
8 LED COM
7 LED COLON
6 STW/TAPE
5 START/STOP
4 BLANK
3 A.C. IN
2 F SEL
1 Vss
R916 56
D852 TLR122
D853~855 TLG121
D98
1S2473
D851 SY406TY
PAUSE
D852 D858
D853 D857
F.FWD
D854
PLAY
D855
REW
SW106 PAUSE
SW105 REC
SW104 STOP
SW103 F.FWD
SW102 PLAY
SW101 REW
+12V
R851 560
R852 1.2K
R853 560
R854 560
R855 560
IC852
TD62503P,
M54514AP
or TD62502P
X851
R856 390
C851 100P
C852 56P
C853 0.022
C854 0.022
C855 0.022
C856 0.022
C857 0.022
C858 0.022
C859 0.022
C860 0.022
Q907 2SC2603(F)or(E)
R919 27K
R920 56K
R921 1.2K
D857,858
1S2473
Q902
2SA1305(Y)
REC
+11
R903 560
R904 27K
R905 56K
R906 10K
R918 12K
R901 56K
R902 2.7K
Q903
2SA1115
(F)or(E)
Q901
2SC2603(F)or(E)
IC901 TC4001BP
R907 330K
R908 100K
R909 100K
R910 100K
R911 4.7K
R912 270K
R913 1K
R914 10K
C901 D902
0.47/50
C902 0.01
D903
D904 1S2473
Q904
2SC2603(F)or(E)
Q905
2SA1115(F)or(E)
D902,903
1S2473
SW802(1/2) OFF
SW801 PLAY
SW802(2/2) OFF
SW803 REC
D867 1S2473
D868 1S2473
AUTO replay
SW903
D869 1S2473
AUTO rewind
SW902
D870 1S2473
TIMER
memory
SW901
D872 1S2473
R922 10K
R917 56K
Q906
2SC2603(F)or(E)
SW2
LP802
Q851 D859
Q852 D860
Q853 D861
Q854 D862
Q855 D863
Q856 D864
R857 R858 CAS
R859 R860 WPS
R861 R862 SCAN
R863 R864 K(10)
R865 R866 D865 K(1)
R867 R868 D866 K(2)
C861 100P
Q851~856
2SA1115(F)or(E)
D859~866
1S2473
Q6
2SA1286(H)
R13 10 1/2W (FR)
R28 1K
Q7
2SC2603(F)or(E)
R16 10K
R14 3.3K
R15 27K
2SC2603
(F)or(E) Q12
R25 1K
Q13
2SC2603(F)or(E)
R24 56K
R23 27K
+11
-13
+13
P-M2
P-M1
RESET
+12
⑫
SB
⑧
WAIT
C5 470/16
C6 470/16
D58 1S2473
Q51
2SA1115
(E)or(F)
R55 56K
D57
1S24



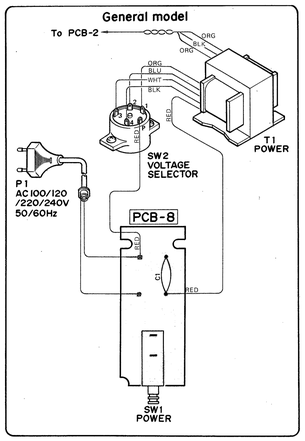
..... **RECORDING SIGNAL (Lch)**

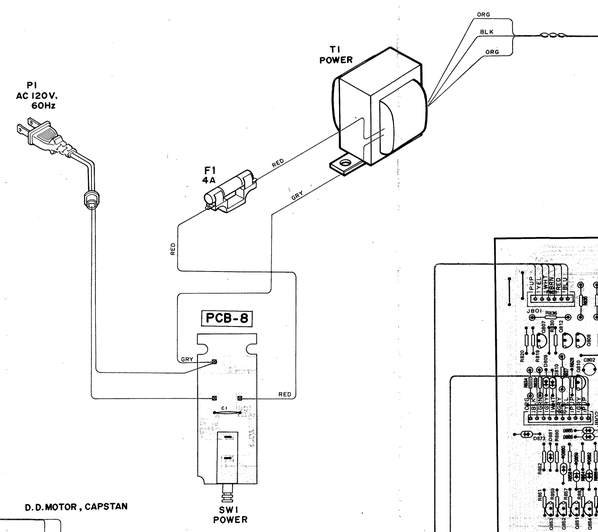
..... **PLAYBACK SIGNAL (Rch)**

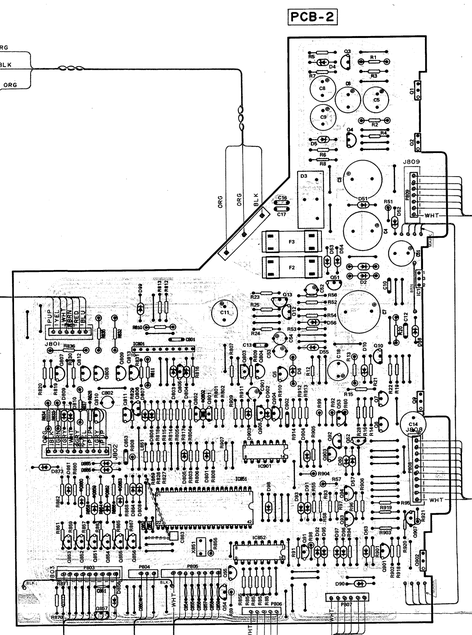
..... **HX-PRO SIGNAL**

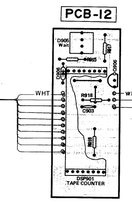
1. ALL RESISTANCES VALUES ARE IN Ω.
   kΩ= 1000Ω, MΩ= 1000kΩ
2. THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCES VALUES ARE IN μF UNLESS OTHERWISE NOTED. P = μμF AND ALL ELECTRICAL CAPACITANCES VOLTAGE VALUES ARE GIVEN WITHOUT UNIT. THE OMITTED UNIT IS V. 47/50 → 47μF/50V
4. V: DC VOLTAGE AT NO SIGNAL
   ... V STOP MODE
   [...V] PLAYBACK MODE
   (...V) RECORDING MODE
5. ⚠ SAFETY-REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS. THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.

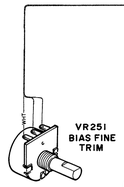
WIRING DIAGRAM

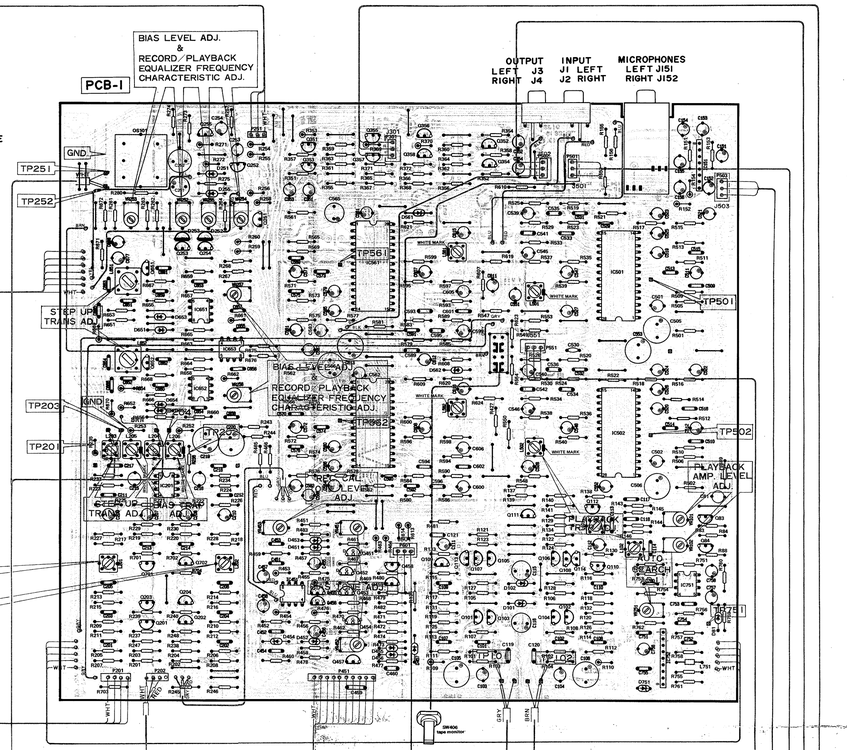


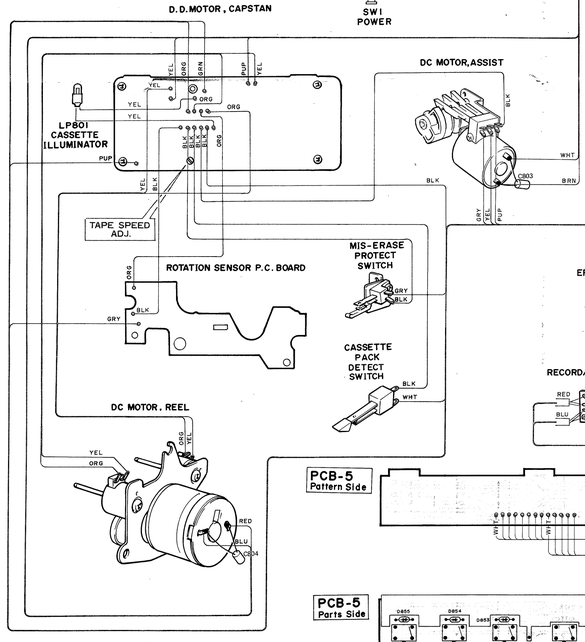


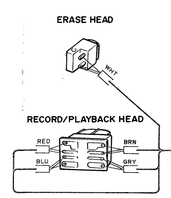


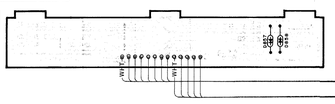


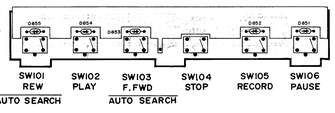


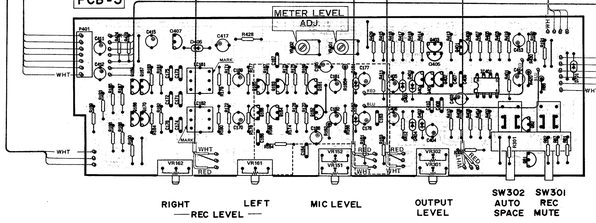


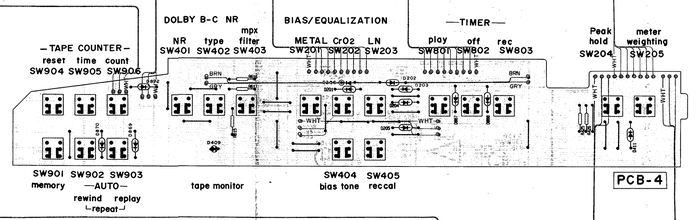


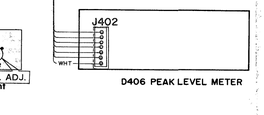


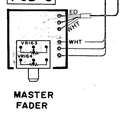


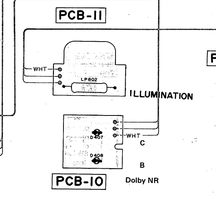


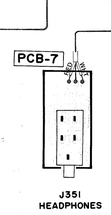






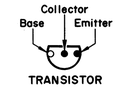


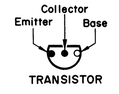




PIN CONNECTION DIAGRAM OF TRANSSISTORS, DIODES AND ICS.

2SA1286 2SC2603	2SA968 2SC2236 2SC3246	2SA1217 2SC2877	2SA1305	RD4.7JB2 RD5.1EB2 RD5.6JB2 RD6.2JB2 RD6.8EB2 RD8.2JB1 RD8.2JB3 RD10JB2 RD11JB2 RD12JB1 RD13EB2	KB265 MV-12	MC921	SY406TK	GL5HD5	TA78012AP	HA17082PS	BA335	TC4001BP	TD62503P
2SA999L 2SA1115 2SA1190 2SC945L 2SC2320L 2SC2855 2SC2878	2SK246	2SK381	1K34A 1S2471 1S2473 HZ9B2L HZ11B2L HZ12C2L DS135E ERC0402F		GL5HD22	GL9PG19 GL9HY9	TLR122 TLG121	S1RBA	M5218L	M5220P M5218P	BA6109	HA12058-01	M58846-641SP

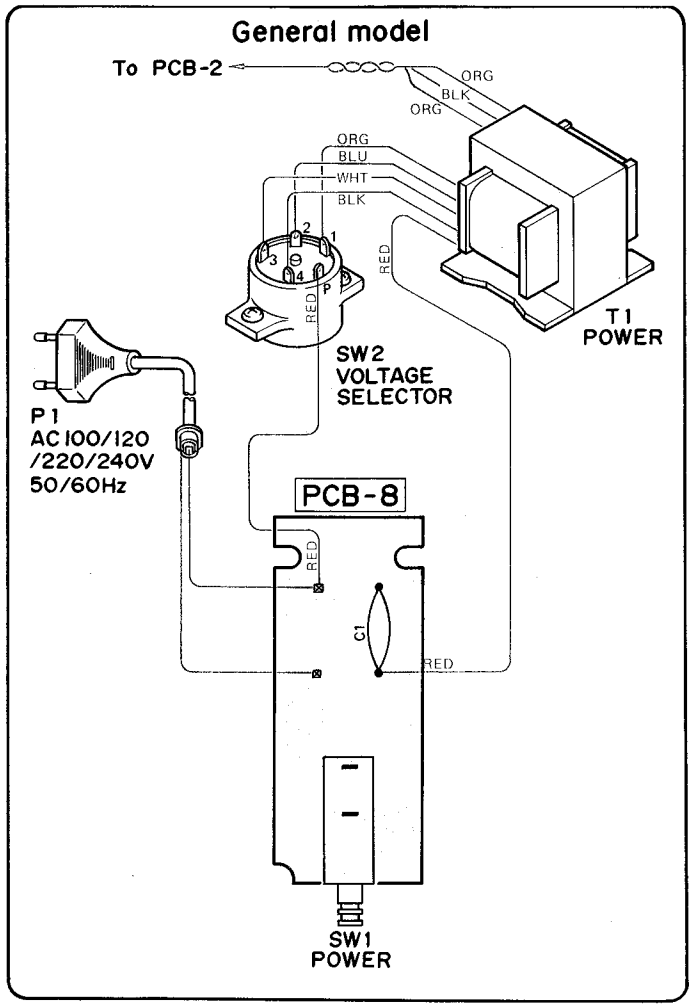


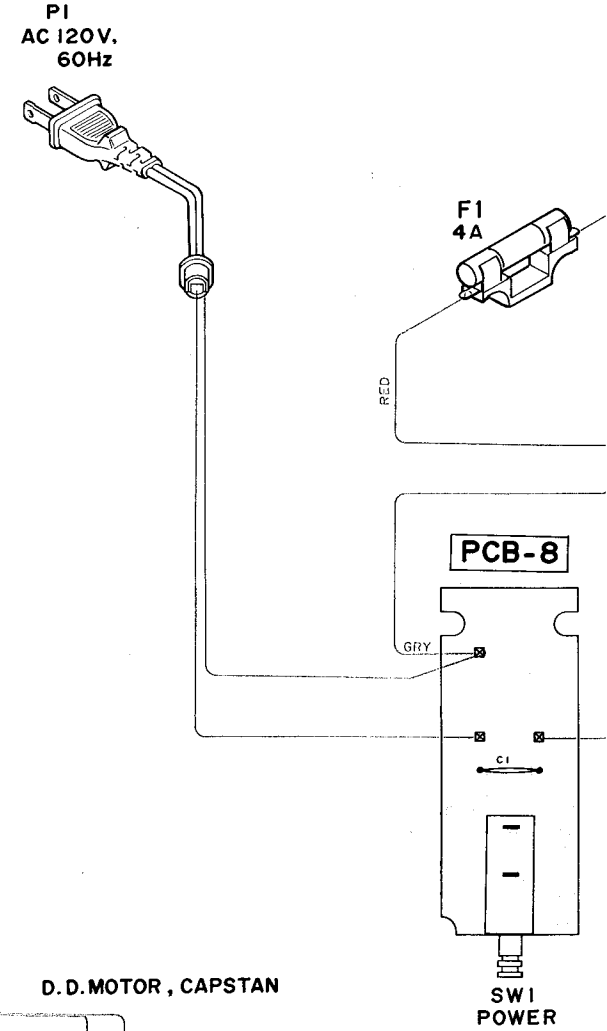


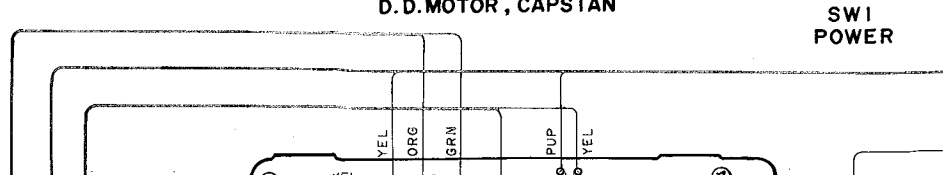
*WIRE COLOR ABBREVIATIONS
RED : Red
ORG : Orange
BLU : Blue
WHT : White
GRN : Green
BLK : Black
YEL : Yellow
PUP : Purple
PIK : Pink

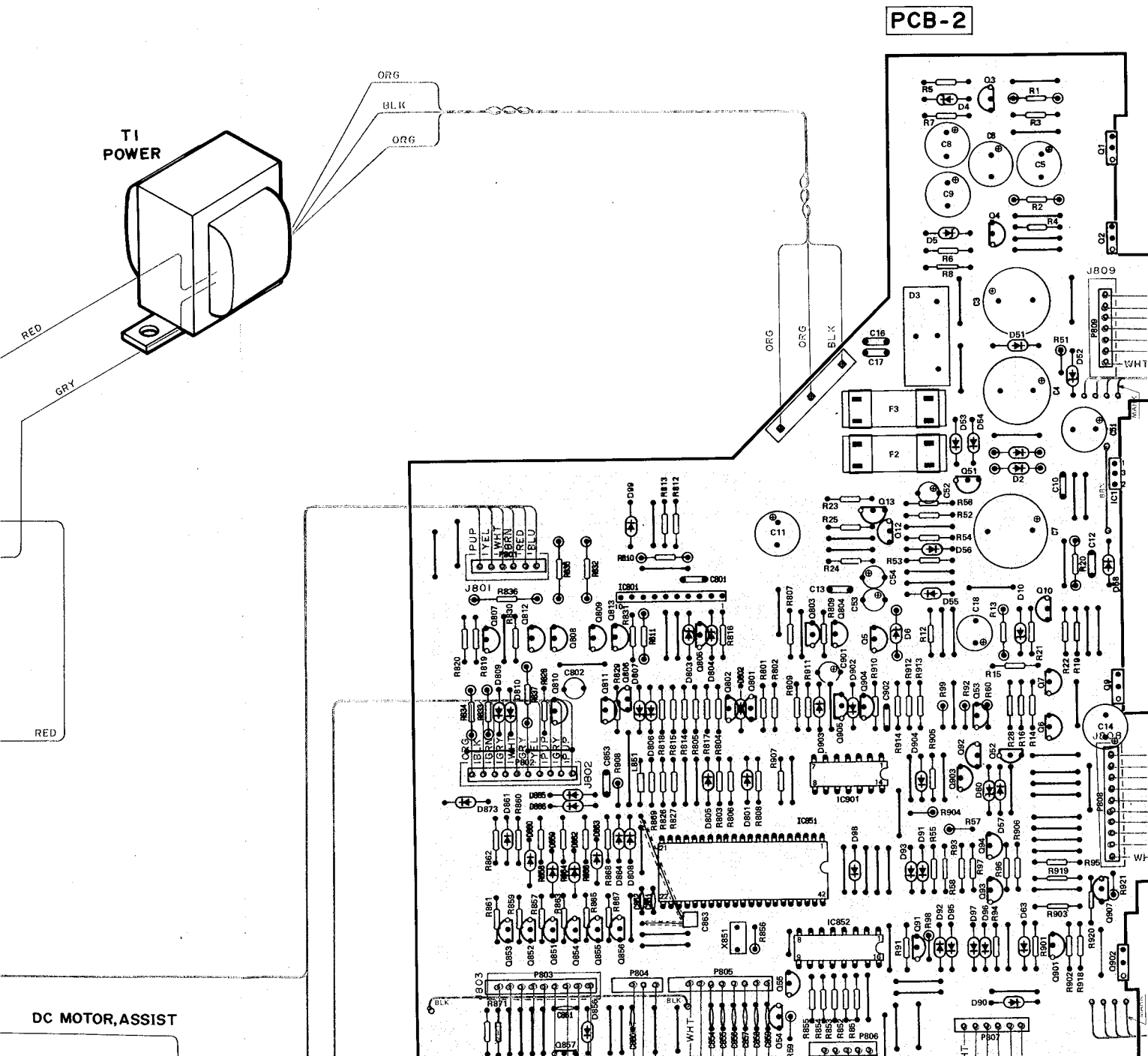
10601-

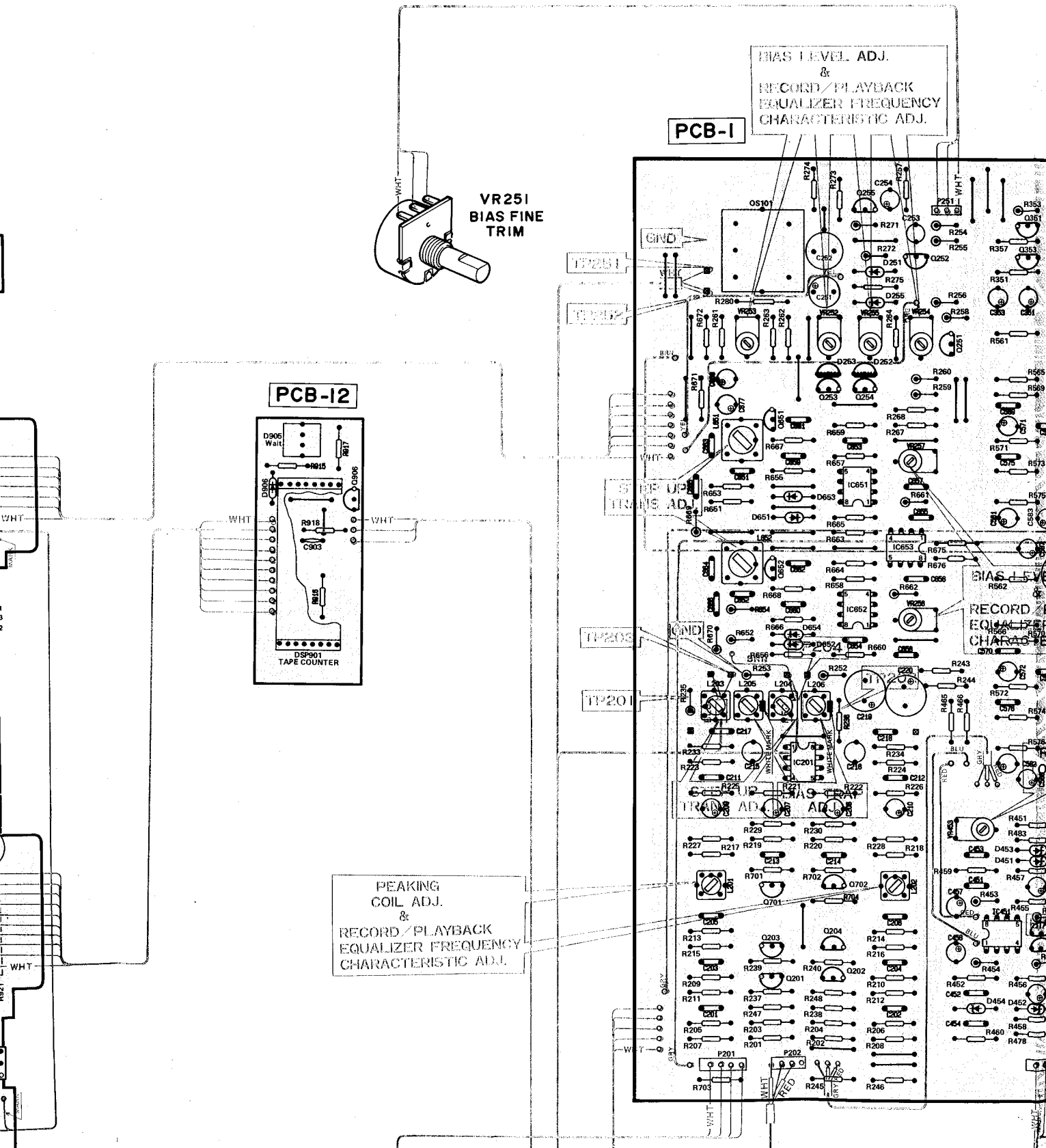
WIRING DIAGRAM



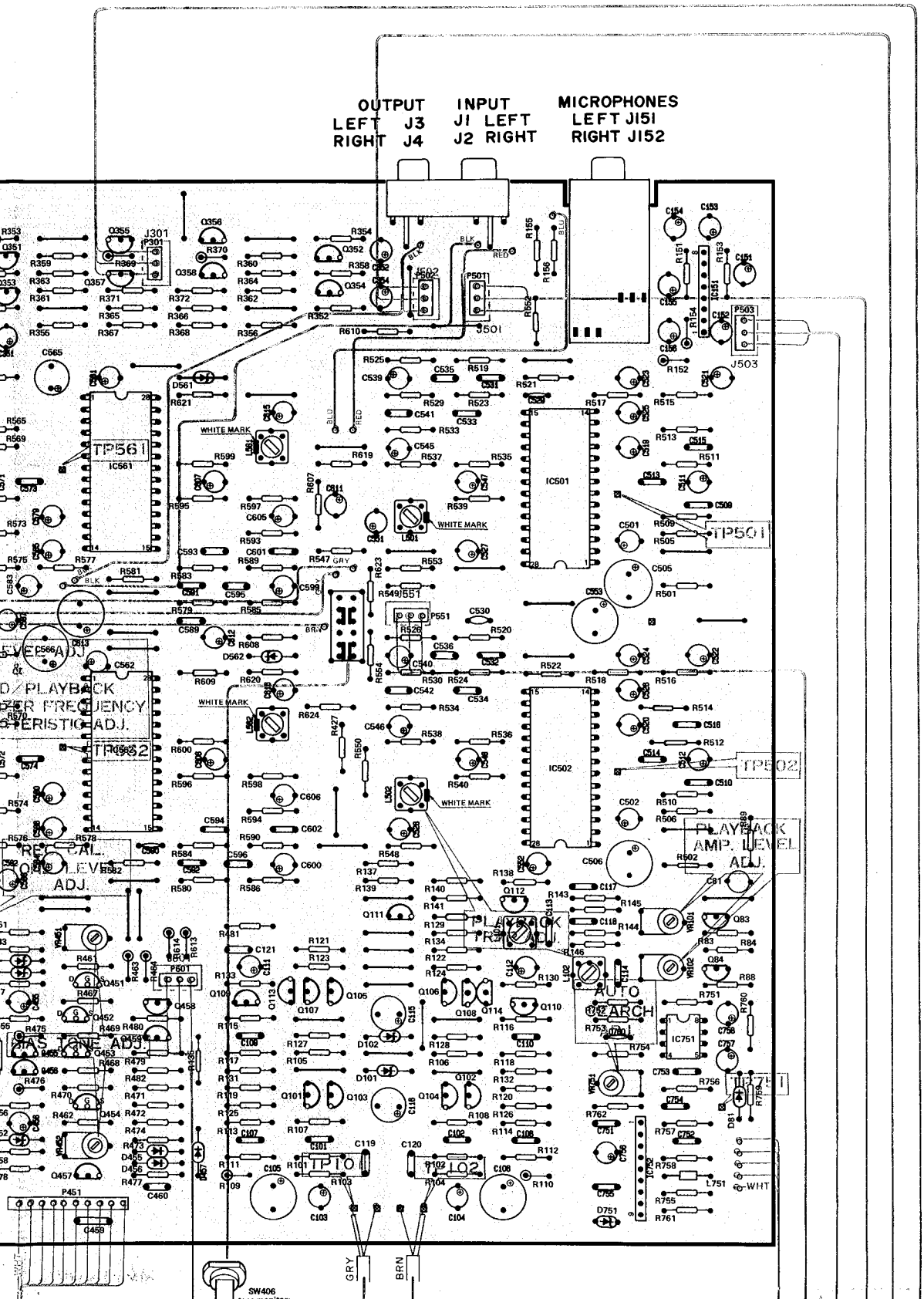


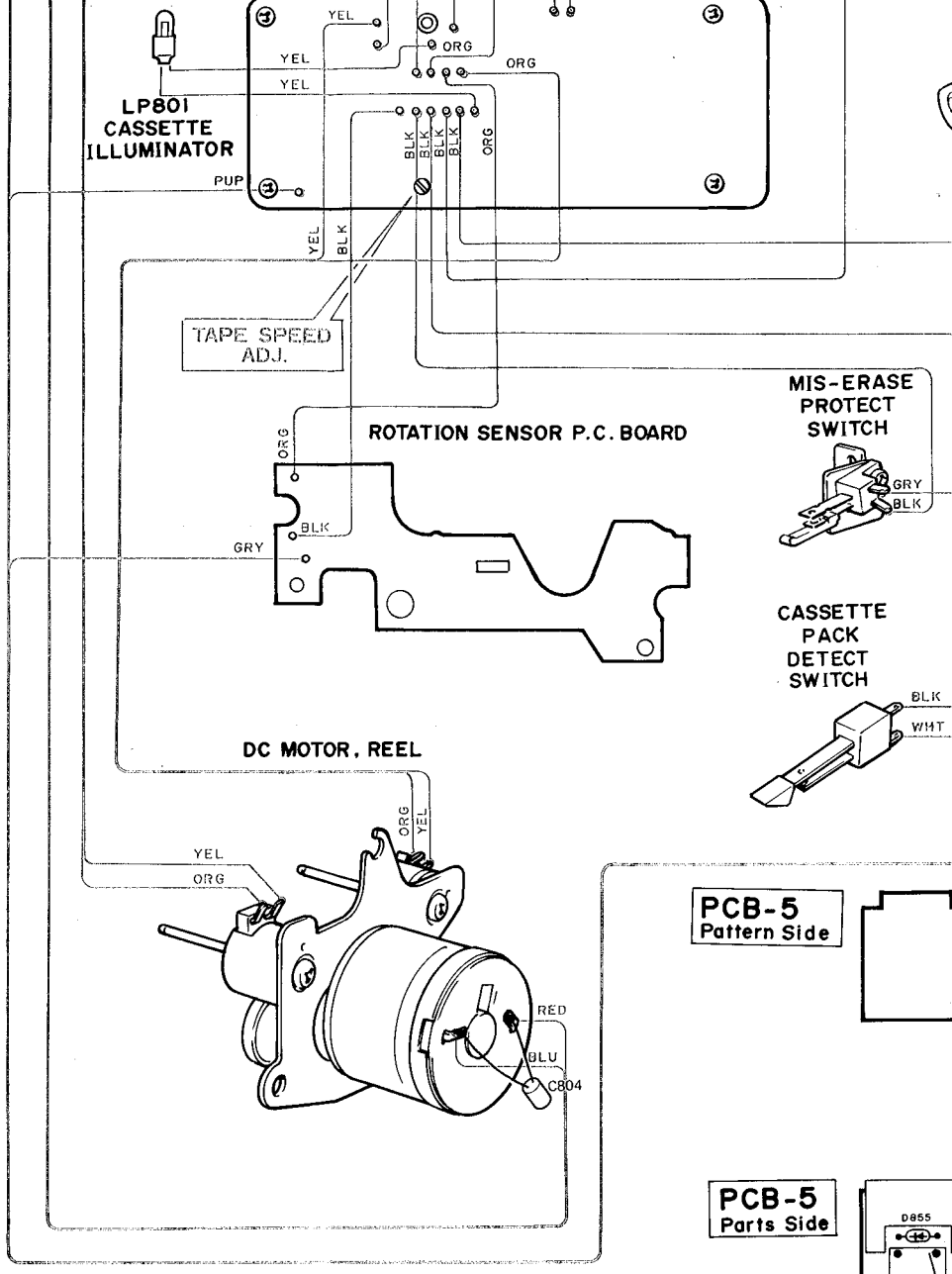



PCB-2
TI POWER
ORG
BLK
ORG
RED
GRY
ORG
ORG
BLK
RED
DC MOTOR, ASSIST
J801
J802
J803
J809
IC801
IC851
IC852
IC901
P803
P804
P805
P806
P807
P809
WHT
BLK


PCB-I
PCB-I2
VR251
BIAS FINE
TRIM
BIAS LEVEL ADJ.
&
RECORD/PLAYBACK
EQUALIZER FREQUENCY
CHARACTERISTIC ADJ.
PEAKING
COIL ADJ.
&
RECORD/PLAYBACK
EQUALIZER FREQUENCY
CHARACTERISTIC ADJ.
DSP901
TAPE COUNTER
TP251
TP252
TP203
TP201
GND
WHT
RED
GRY
BLU

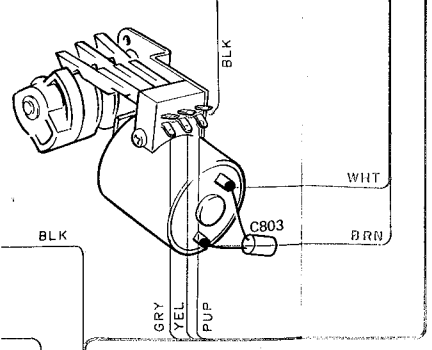
M	N	O	P	

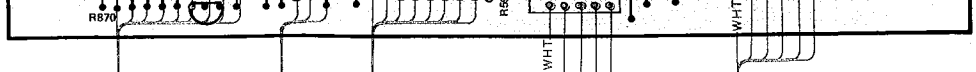

OUTPUT
LEFT J3
RIGHT J4
INPUT
J1 LEFT
J2 RIGHT
MICROPHONES
LEFT J151
RIGHT J152
J301
J502
P501
J501
P503
J503
TP561
IC561
IC501
TP501
TP502
IC502
WHITE MARK
P551
P601
P451
TP101
TP102
SW406
GRY
BRN
WHT
PLAYBACK
AMP. LEVEL
ADJ.
AUTO
SEARCH
IC751



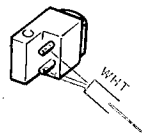
PIN CONNECTION DIAGRAM OF TRANSSISTORS, DIODES AND ICS.

2SA1286 2SC2603	2SA966 2SC2236 2SC3246	2SA1217 2SC2877	2SA1305	RD4.7JB2 RD5.1EB2 RD5.6JB2 RD6.2JB2 RD6.8EB2 RD8.2JB1 RD8.2JB3 RD10JB2 RD11JB2 RD12JB1 RD13EB2	KB265 MV-12	MC921	SY406TK
2SA999L 2SA1115 2SA1190 2SC945L 2SC2320L 2SC2855 2SC2878	2SK246	2SK381	1K34A 1S2471 1S2473 HZ9B2L HZ11B2L HZ12C2L DS135E ERC0402F		GL5HD22	GL9PG19 GL9HY9	TLR122 TLG121

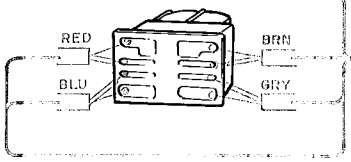


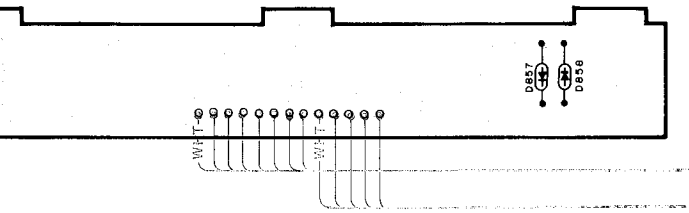


ERASE HEAD

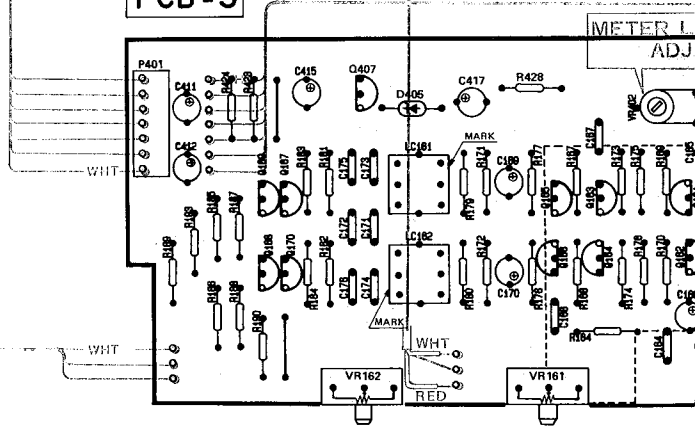


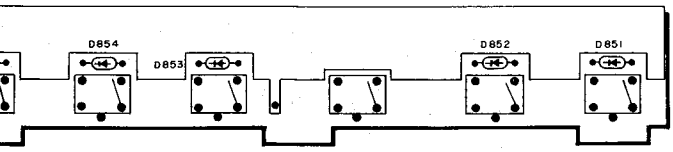
RECORD/PLAYBACK HEAD





PCB-3





SW102 PLAY

SW103 F.FWD

AUTO SEARCH

SW104 STOP

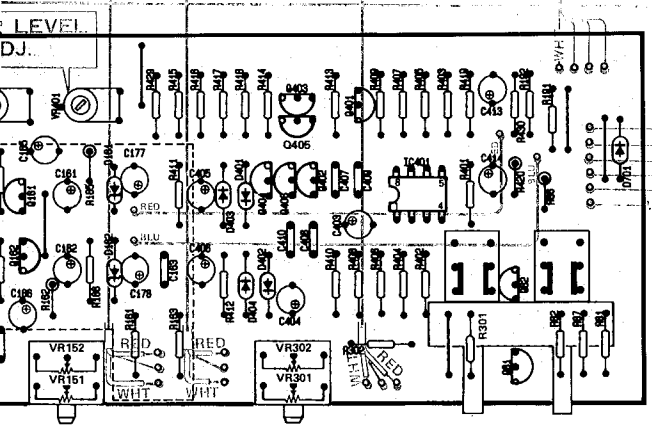
SW105 RECORD

SW106 PAUSE

RIGHT LEFT

REC LEVEL

	GL5HD5	TA78012AP	HA17082PS	BA335	TC4001BP	TD62503P
	S1RBA	M5218L	M5220P M5218P	BA6109	HA12058-01	M58846-641SP



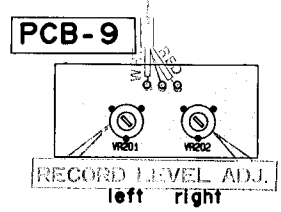
MIC LEVEL

OUTPUT LEVEL

SW302 AUTO SPACE

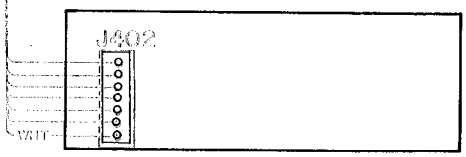
SW301 REC MUTE

PCB-9



left right

rec cal



D406 PEAK LEVEL METER

DOLBY B-C NR

mpx

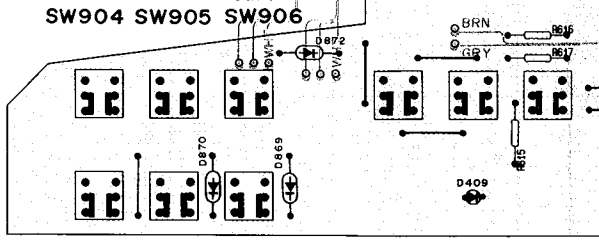
NR type filter

SW401 SW402 SW403

— TAPE COUNTER —

reset time count

SW904 SW905 SW906



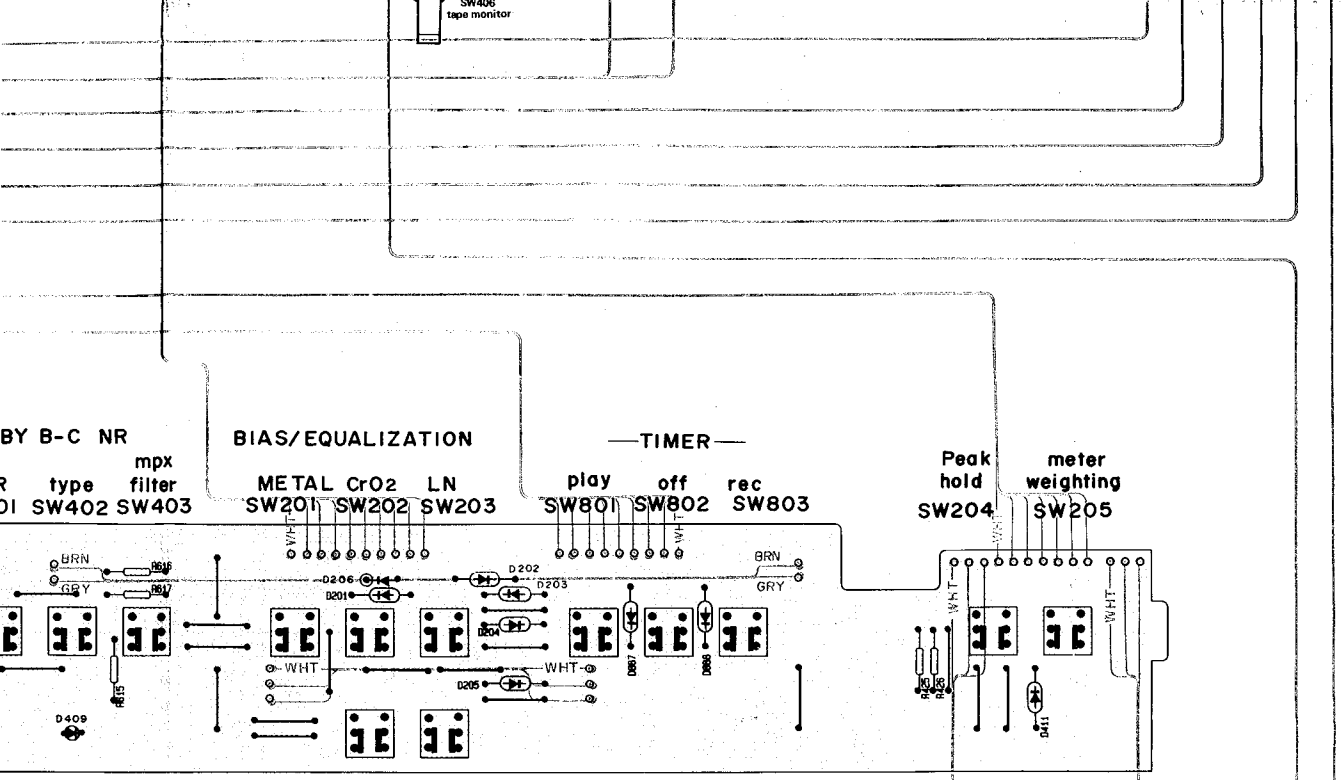
SW901 SW902 SW903

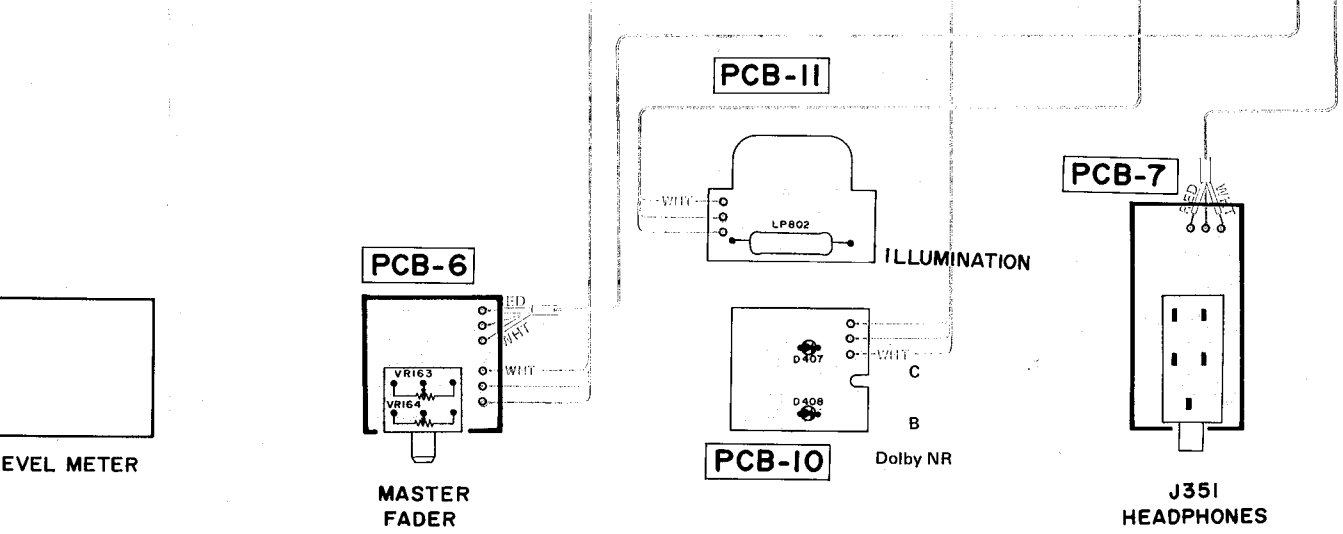
memory —AUTO—

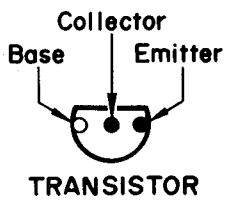
rewind replay

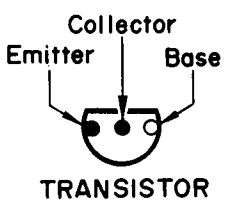
└repeat┘

tape monitor









- WIRE COLOR ABBREVIATIONS

RED	: Red
ORG	: Orange
BLU	: Blue
WHT	: White
GRN	: Green
BLK	: Black
YEL	: Yellow
PUP	: Purple
PIK	: Pink

10601-

harman/kardon

Service Bulletin

SERVICE BULLETIN #4005 - DECEMBER, 1984

TO: ALL HARMAN KARDON WARRANTY STATIONS

MODEL: CD391/CD491 STEREO CASSETTE DECK

SUBJECT: POP SOUND RECORDED ON TAPE

In the event you receive a CD391 or CD491 Cassette Deck with the complaint "unit records pop or bleep on tape when placed in record pause mode" we recommend you solder on the micro processor PC Board a signal diode between IC 801 and IC 852.

The anode of this diode is connected to PIN 6 of IC 801 and the cathode of this diode is connected to PIN 14 of IC 852.

The purpose of this diode is to prevent the transport from rewinding the tape momentarily at the moment the pause button is depressed.

Due to this momentary rewind of the tape while the bias oscillator is on, the bias signal will be recorded on the tape at high tape speed. When the tape is played back this high frequency signal becomes audible.

The modification indicated above will prevent this momentary rewind.

Harman Kardon Incorporated, 240 Crossways Park West, Woodbury, New York 11797 (516) 496-3400 TELEX: 22 99 11 HARMN UR